ENGINEERING NEWS-RECORD

DECEMBER 18, 1941

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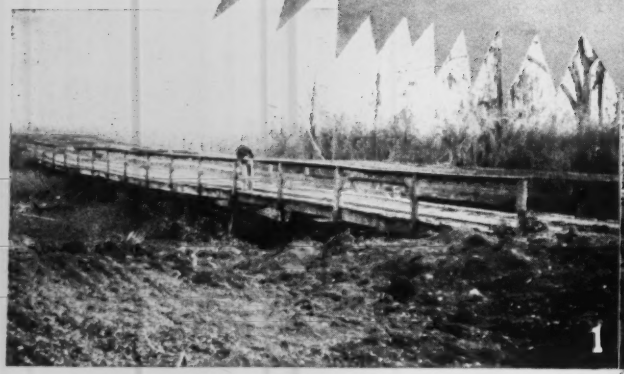
Friant Dam

Precast concrete units to support the roof of a Navy warehouse at San Pedro.

"War is Hell"

...ON BRIDGES!



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2 **Strength to spare! In actual tests a Multi Plate Arch 10 feet long and with a 20-foot span withstood loads up to 350 tons.**

3 **Full speed ahead! A few days and you have a bridge that will last as long as the road. Finish off with any headwall you like.**

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A TYPE OF PRODUCT ORIGINATED AND DEVELOPED BY ARMCO ENGINEERS

ENGINEERING NEWS-RECORD

Devoted to Buildings, Sewers, Waterworks, Bridges, Highways, Streets, Dams, Foundations, Earthwork, Flood Control, Public Works, Irrigation, Canals, Railroads

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Vol 127 DECEMBER 18, 1941 No. 25

THIS WEEK

• A new procedure in drydock building has been developed during the construction of a Navy graving dock, and the present article outlines the unusual unwatering and concreting methods, which permitted the floor to be poured in-the-dry.

• Discrepancy between actual loads sustained by test piles and the load figures derived from widely accepted pile formulas has led to the development of a new formula, which the author explains and offers for consideration.

• Precast concrete joists and beams, produced in a plant designed for accurate control of the mix and factory output, have been used with economy in time and money for framing the roof of a Navy warehouse. Their manufacture and erection are described.

• TVA is rushing an emergency construction program to help meet power needs for national defense. The water storage facilities to be provided and the status of the work are reviewed in an authoritative article by T. B. Parker, chief engineer of TVA.

THINGS TO COME

• Design information on large, cellular, sheetpile cofferdams is relatively scarce, and a forthcoming article will present detail data on the cofferdam for TVA's Kentucky Dam.

• New to American bridge practice is the 540-ft. tied arch with the tie constituting the heavy member, resisting most of the live load and serving as a stiffening girder for the arch rib. Articles will review both design and construction of this unusual structure.

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THE *A B C* OF SAFER NIGHT DRIVING

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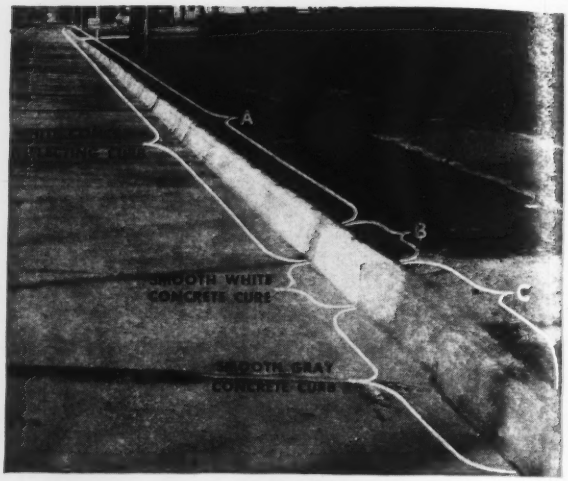
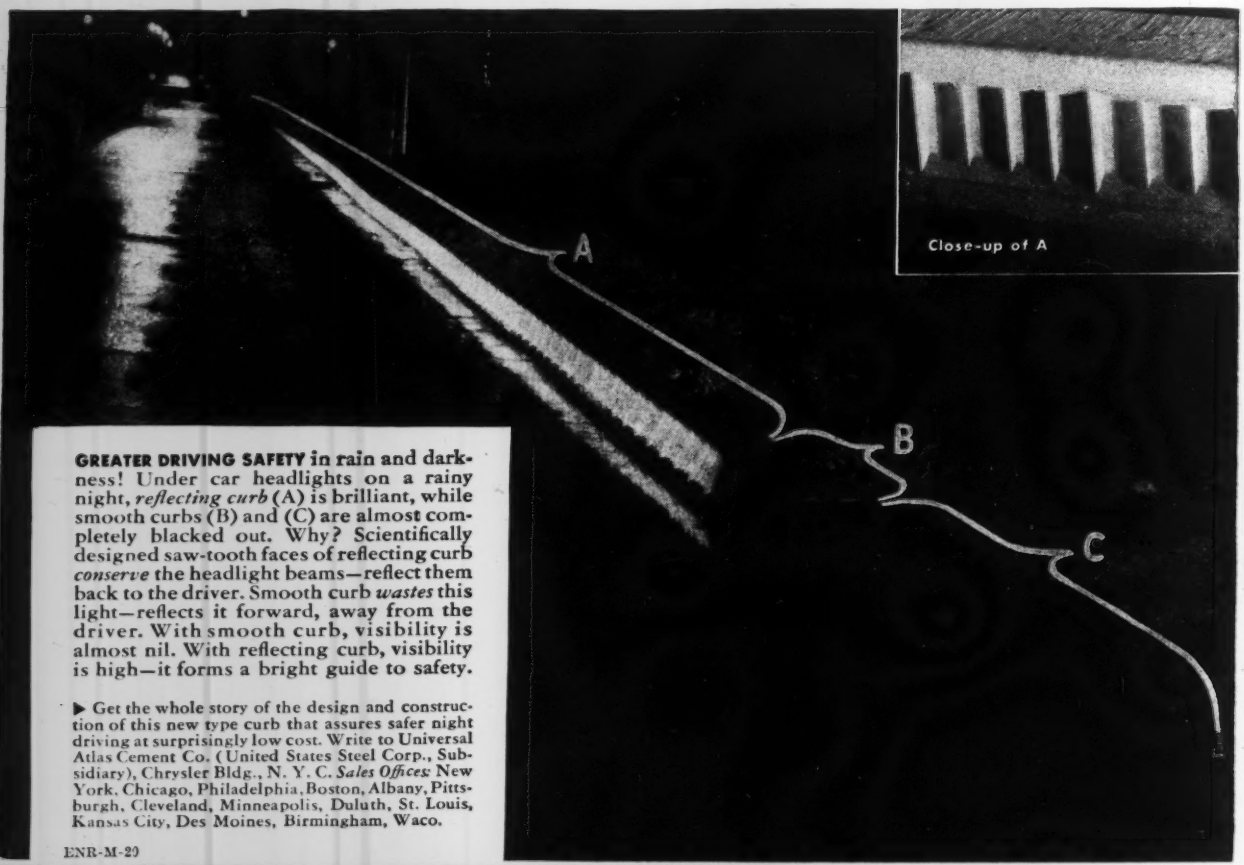
. . . Three types of curb at one location prove superiority of White Concrete Reflecting Curb



Reflecting white concrete curb (A), *smooth white* concrete curb (B), and *smooth gray* concrete curb (C), at one New Jersey location. In the night photograph below, note the great difference in visibility of the three curbs under car headlights on a rainy night. Contractor, Jannarone Contracting Co., Belleville, N. J.; Curb Contractor, Frapaul Construction Co., Inc., Hackensack, N. J.



Close-up of A

GREATER DRIVING SAFETY in rain and darkness! Under car headlights on a rainy night, *reflecting curb* (A) is brilliant, while smooth curbs (B) and (C) are almost completely blacked out. Why? Scientifically designed saw-tooth faces of reflecting curb *conserve* the headlight beams—reflect them back to the driver. Smooth curb *wastes* this light—reflects it forward, away from the driver. With smooth curb, visibility is almost nil. With reflecting curb, visibility is high—it forms a bright guide to safety.

▶ Get the whole story of the design and construction of this new type curb that assures safer night driving at surprisingly low cost. Write to Universal Atlas Cement Co. (United States Steel Corp., Subsidiary), Chrysler Bldg., N. Y. C. *Sales Offices:* New York, Chicago, Philadelphia, Boston, Albany, Pittsburgh, Cleveland, Minneapolis, Duluth, St. Louis, Kansas City, Des Moines, Birmingham, Waco.

ENR-M-29

WHITE CONCRETE REFLECTING CURB

MADE WITH ATLAS WHITE CEMENT

Congress adds ten billion appropriation for defense

Air force gets $600,000,000 for 25 fields and for buildings. Another $200,000,000 is for troop housing. Naval shore establishments receive $335,000,000

Congress this week completed action on the ten-billion dollar third supplemental defense appropriation containing nearly three and a half billion for construction work. More than a half billion of this for air force facilities was added after the outbreak of war.

By far the biggest construction items in the bill are for the air force, a total of nearly $900,000,000. Of this some $600,000,000 is for building and equipping 25 new Army airfields, 17 of them within the continental U. S. Another $200,000,000 is for troop housing, mostly for air force personnel.

More airfields will also be provided by a $127,000,000 appropriation to expand the construction program of the Civil Aeronautics Authority to cover 504 fields.

For expansion of production facilities, $388,000,000 is appropriated, but most of this will go for machinery rather than new buildings. Perhaps some twenty or thirty new plants for tanks, artillery, and explosives will be built with this money.

For Naval shore establishments, Congress provided about $335,000,000. This is mostly for unspecified projects but includes $18,750,000 to convert Floyd Bennett Airfield in New York into a naval air station and $15,000,000 for a supply depot at Mechanicsburg, Pa.

Congress turned down pleas of the President and the OPM that money be provided for TVA's Douglas Dam on the French Broad River (*ENR*, Dec. 11, p. 13). Instead it approved $49,000,000 to start Fontana, Holston River, and the Watauga River dams, to expand the Watts Bar and Sheffield, Ala., steam plants, and to install 324,000 kw. in additional hydro generators.

Although the authorization bill is still pending before the Senate, $300,000,000 was appropriated for defense housing. For defense roads and flight strips, $130,000,000 in cash and contract authorization was approved, and for new office buildings in the District of Columbia $25,000,000.

Other sums in the bill include $104,000,000 of additional contract authority for the Panama third locks, $25,750,000 for flood control, $30,000,000 for Bonneville transmission lines, $3,000,000 for Central Valley, and $2,500,000 for the Anderson Ranch reclamation project.

Expansion of utilities forbidden by OPM

Utilities, both publicly and privately owned, were forbidden last week to carry on any expansion of their present facilities unless they are 40% complete, without obtaining specific authorization from OPM. This applies even though the utility has the materials on hand. Only projects costing less than $500 (or $1,500 for underground connections) are exempt. The order, which is an amendment to the utilities priority order, P-46 applies to electric, gas, central steam, water, and sanitary services, whether or not they have ever used P-46. Regular operations of utilities will be somewhat restricted by another amendment limiting monthly withdrawals from inventory.

Can our bridges carry it?

This is a 60-ton tank, first of its tribe, as it was turned over to the Army by the Baldwin Locomotive Works on Dec. 8. The answer to the question of whether highway bridges will carry this new tank is "yes," for any bridge designed for H-15 loading of the American Association of State Highway Officials, provided speed is reduced to 2 mph. and the spacing between tanks is not less than 40 ft.

Known as M1 tanks in contrast to the "medium" M3 tanks now being built at the Baldwin and other plants around the country, this new tank is characterized as the greatest fighting vehicle yet built. Cast steel is used in its construction to a greater extent than ever before. Another novel element is the 3-in. high-velocity gun, which will make this tank superior to the German 90-ton tanks.

War brings tests of civil defense plans

Throughout the nation last week city engineers and public officials were busy testing and overhauling their plans for sabotage protection and civilian defense. Actual air raid alarms were sounded in some of the larger cities, particularly on the Pacific Coast where blackouts of principal cities put reality into civil protection for the first time. For the most part preparedness plans, well-thought out in advance, went into effect without delay. Military guards were placed on bridges, piers and other vulnerable points, while safeguards at power plants, shipyards and other strategic locations were augmented.

In California provision was made for blacking out all lighted state highway bridges and facilities for extra fire protection were provided. At San Francisco, street facades of some buildings housing important public facilities were piled to second floor levels with sandbags. Armed guards were placed at dams which store city water supplies; important aqueducts were being patrolled, and carefully prepared plans for speedy communication, worked out well in advance, were promptly put into effect. For example, very special attention was given to the entire length of the Los Angeles aqueduct.

From Oregon comes the report that the state highway engineer had put into effect a program of guarding strategic bridges, highways and tunnels. All along the West Coast precautionary measures were being taken, in most cases according to advanced plans, which has been ready for some time, needing only the "go" signal to put them into effect.

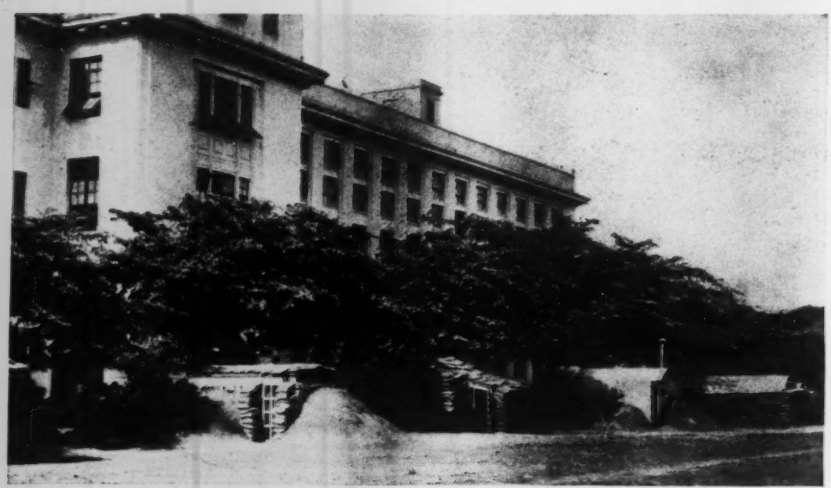
In Chicago the first steps in the emergency protection plans were put into operation with other planned emergency measures held in readiness. The city had already augmented its inventories of critical supplies and materials including standby machinery for some of the more vital services. In New York, the Port of New York Authority announced that additional floodlights had been placed at strategic points on bridges and tunnels. Guards have been strengthened at city bridges while a good many months ago bridge shoes and cable anchorages had been enclosed or otherwise made inaccessible.

Throughout the Nation civil defense activities were well under way according to advance plans and every precaution was being taken to meet any emergency.

Associated Press Photo

San Francisco buildings sandbagged

With the first news of attack by Japanese on U. S. Pacific island possessions the piling of sandbags along the fronts of important buildings in San Francisco was started. This view shows an example of sandbag protection for a strategic building in that city.



Wide World Photo

Bomb shelters in the Philippines

While Manila was suffering heavy bomb raids and the Philippines generally were being subjected to attack, students at the University of The Philippines were using bomb shelters as illustrated above, which were constructed on the university campus under supervision of the National Air Raid Warden. The necessity for building bomb shelters above ground is caused by the fact that groundwater is close to the surface.

• • •

U.S.H.A. experiments with pre-cast concrete slabs

In the interest of speed and economy, the United States Housing Authority is using pre-cast concrete slabs in constructing a 15-unit defense housing project at Alexandria, Va. for Army enlisted personnel at Fort Belvoir.

The first floor will be conventionally built with poured concrete in one piece, but the walls, second floor and roof will be constructed of pre-cast concrete panels, hoisted into place and bolted together. The wall panels, 18 in. wide and 2½ in. thick, will be set in place vertically, with calking between the joints. They are designed to facilitate furring, so that an insulating air space may be provided between exterior concrete and plaster.

Reversing the usual procedure in prefabrication, the general contractor will move his plant to the job, performing all mechanical operations on the site.

Privately financed defense houses will get priority to aid completion

About 70,000 houses now under construction will receive an A-10 rating. Bill for publicly-financed housing advances in Congress.

With priority ratings already issued covering construction of some 78,000 privately financed defense houses, Priorities Division of OPM last week announced that it is prepared to give priority help in the completion of dwelling-construction projects which had foundations in place on Oct. 9. It is estimated this would cover about 70,000 dwelling units, about 50% finished on the average.

A rating of A-10 will be granted applicable to purchase of items on the Housing Priorities Critical List. Application for the rating should be made to field offices of the Federal Housing Administration, which will clear applications to the Priorities Division field offices. Applications will not be received before Dec. 22 nor, probably, after Jan. 31.

Priority ratings have already been granted to permit completion of USHA slum-clearance projects. A rating of A-9 was given last week to 26 projects which are more than 50% finished and a rating of A-10 to other projects which have foundations in place.

Meanwhile, the House approved the new bill authorizing an additional $300,000,000 for publicly-financed defense housing (*ENR*, Dec. 4, p. 55). The bill still retains the requirement that all the work be done by Public Buildings Administration.

Added to the bill is a new section authorizing an additional $150,000,000 for emergency public works, bringing the authorized total for this purpose to $300,000,000.

• • •

Philadelphia awaits OPM ruling on water program

Philadelphia's $18,000,000 water improvement program is being held up awaiting a decision by the Office of Production Management on priorities for necessary machinery, pipes and other essential materials and equipment.

The value of critical material, such as copper, steel, brass and aluminum, is estimated at $6,900,000, and thus far the city has been granted a rating on only half of 40 priorities applied for, which, according to John H. Neeson, director of public works, places the city well down on the priorities list.

Philadelphia has done nothing in seeking priorities for its proposed $42,000,000 sewage improvement program.

• • •

Last concrete lining on Draper-Alpine tunnel

Concrete work on the three-mile Draper-Alpine tunnel has been completed. This project is part of the Salt Lake aqueduct division of the Provo river development. The concrete-lined tunnel is 6 ft. 6 in. in diameter and will carry approximately 160 sec.ft. of water.

According to E. O. Larson, engineer in charge of construction for the U. S. Bureau of Reclamation, this was one of the most difficult tunnel jobs ever completed by the Bureau of Reclamation because of a soft, volcanic formation which extended most of the way through the mountain. This material developed heavy pressure, crushing 12x12 timbers and steel supports. The difficulty was finally overcome by excavating the bore to a diameter of 19 ft. in some places, putting in large timbers for temporary support, then placing steel plates inside the timbers and filling in with concrete, using quick-setting cement. In the worst sections the concrete lining is as much as 4 ft. thick, in addition to timber and steel supports.

Contractor for the tunnel, as well as for the previously completed 3,600-ft. Olmstead bore, is the George K. Thompson Co.

• • •

Highway labor relations supervisor appointed

Minnesota's highway commissioner M. J. Hoffman has announced establishment of a full-time labor relations supervisor. Eugene A. Dahl, AFL union leader of Minneapolis, has been named to the post. Mr. Dahl has been serving as safety supervisor for the state industrial commission.

Under the supervision of the highway commissioner, duties of the new official would be to study and make recommendations on all matters involving application of the civil service provisions, wages, hours and working conditions among highway employees. He would maintain contacts with the unions of highway groups involved.

Steel being placed for largest service hangar

Steelwork has been started on the superstructure of what is believed to be the largest airplane service hangar in the country, a building providing floor area of 139,800 sq.ft.

The main hangar will be 150 ft. by 800 ft. with concrete floor and steel columns supporting steel roof trusses 16-ft. deep. A 35-ft. vertical clearance from floor to trusses will be provided. A door 300 ft. wide by 35 ft. high will be installed along the south wall, and on the west end there will be a door opening 150 ft. wide by 35 ft. high; both to be electrically operated.

Parkinson & Parkinson, Los Angeles, are architects, and H. W. Baum Co., general contractors.

The structure is being built for the Lockheed Aircraft Corp., and J. D. Middleton is engineer on the job for the Lockheed Co.

Arkansas gets $1,000,000 for road construction

Arkansas's State Highway Department will have an additional $1,000,000 for the next two years to finance construction and maintenance of roads, as a result of an opinion recently handed down by Jack Holt, state attorney general. The ruling of the attorney general authorizes the state treasurer to transfer for the fiscal year $250,000 of surplus highway funds to the maintenance account and $250,000 to the construction account.

A refunding bill provided that $3,075,000 should be set aside for maintenance and $2,250,000 be provided for construction out of the first $13,000,000 in highway revenues derived from gasoline taxes and auto license fees. However, the highway department appropriation bills allocated $3,325,000 for maintenance and $2,750,000 for construction.

Attorney General Holt's opinion held that the additional $500,000 annually provided by the appropriation bills could legally be taken out of the revenue in excess of the $13,000,000 pledged by the refunding act.

• • •

Modern construction save many lives in plant blast

Six men were killed, seven are missing, and 21 others were injured in a TNT explosion which demolished a three-story building at the Iowa Ordnance Plant, Burlington, Iowa, on Dec. 12. Cause of the blast is unknown.

The destroyed building was 100x150 ft., three floors and basement. A duplicate building 560 ft. away was unharmed.

Inside walls of the building were of reinforced concrete, separating the TNT melting line from the "pouring" phase of the operation. The partitions were designed to confine explosions to a single unit, and the exterior walls to spread the explosion without allowing it to reach adjoining structures.

"The reassuring thing about the tragedy is that it proves modern construction with safety devices and safety distances between the main units can confine explosions to the building in which the blast occurs, said Lieut. Col. Keith F. Adamson, commanding officer.

"If this blast had happened during the World War," said Col. Adamson, "we would not have had any plant, but we would have had many more dead and injured workmen. That kind of explosion in a World War ordnance plant would have gone through other buildings like fire, razing them as it went."

The $50,000,000 plant is spread over 20,000 acres.

• • •

Request revision of Chicago's building code

Representatives of six Chicago business organizations have contacted Mayor Kelly of that city asking that the new Chicago building code be revised to permit substitutions for scarce building materials.

The request was presented in order to speed up defense housing construction. Organizations represented were: Chicago Building Congress, Chicago Association of Commerce, Chicago Real Estate Board, Chicago chapter of the American Institute of Architects, Chicago Mortgage Bankers' Association, and Metropolitan Chicago Home Builders.

Construction men join in defense of bases

Men working for contractors engaged in building new defense facilities at Wake and Midway Islands in the Pacific joined with the small group of Marines on the islands in defending them against Japanese invaders, according to meager reports from those islands that have been made public. As this issue goes to press the limited American forces on the islands are reported to be still holding out despite bombing and attack from surface vessels.

Contract for the construction of defense facilities on these and other Pacific islands for the Bureau of Yards and Docks of the Navy is held by Hawaiian Associates, an organization made up of Raymond Concrete Pile Co., Hawaiian Dredging Co., Turner Construction Co., Morrison-Knudsen Co., J. H. Pomeroy & Co., W. A. Bechtel Co., Utah Construction Co., and Byrne Organization. Information as to what men of these companies are on Wake and Midway Islands is not available for publication at this time.

• • •

Mississippi-Louisiana oil pipeline to be built

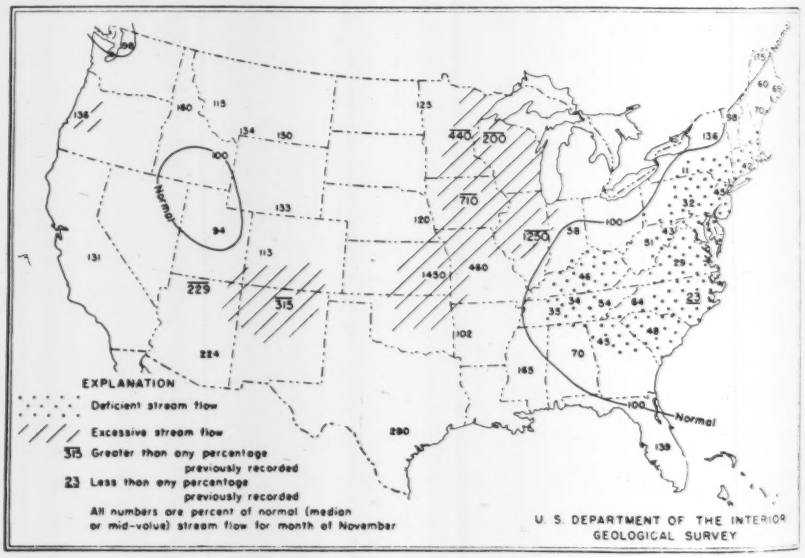
A decision has been reached by oil companies to construct a 10-in. pipeline to carry crude oil from the Tinsley, Miss. field to refineries at Baton Rouge, La. The final decision has not been made as to whether the line will be built and operated by the Oklahoma Pipe Line Co. or some affiliate of the Standard Oil Co. of New Jersey. Construction is expected to start within 60 or 90 days.

Continued drought in East and excess runoff in West Central marked November

The general pattern of stream-flow conditions during November continued without material change from the preceding month. Gaging station surveys showed stream flow below normal in the East, above normal in the West, with marked excess in runoff and flood conditions in the west-central and south plains states. Stream flow in November averaged about 50 percent of normal in an 18-state area covering 450,000 square miles from Maine to Georgia and extending west to Indiana and Tennessee. In this area, during October, stream flow was 39 percent of the October normal.

The Arkansas, White and Red Rivers were in flood during the early part of the month from heavy rains Oct. 28-31.

Rainfall totaling 8 to 13 in. between Nov. 11-17 in the upper Williamette River Basin produced floods on the Row River, Middle Fork of the Williamette River, and Santiam River.


Normal
EXPLANATION
Deficient stream flow
Excessive stream flow
515 Greater than any percentage previously recorded
23 Less than any percentage previously recorded
All numbers are percent of normal (median or mid-value) stream flow for month of November
U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Water service guarded to avert sabotage

Soldiers posted in District of Columbia while other municipalities take steps to prevent service disruptions

With the declaration of war many municipal, state and federal agencies concerned with water supply have put into action plans to avert sabotage of this essential service. As a means for paralyzing industry, handicapping fire protection, or spreading panic among the civilian populace, disruption of water supply is recognized as one of the most effective measures used by saboteurs.

Typical of the steps taken by state authorities was the action in Pennsylvania where more than 1,000 waterworks plants were warned by a letter from the health department to institute precautionary measures immediately. The letter urged that visitors be barred from plants, guards be provided at danger points, and lights installed for illuminating the works, approaches and critical points on the system.

In California, where the larger cities depend on long aqueducts for their water supplies, plans for patrolling and guarding these conduits have been placed in effect; special attention has been given to the 250 mile long Los Angeles aqueduct that serves vital war industries.

In the District of Columbia, where federal funds had been appropriated earlier in the year to eliminate vulnerable spots in the water system, soldiers were assigned to guard critical points (see accompanying photo).

Suggested safeguards

To aid further in the dissemination of information that may be helpful to waterworks authorities at this time, we reproduce in the adjoining columns a check list of sabotage safeguards first published in the July 18, 1940 issue of this journal. The report on sabotage and water service compiled a year and a half ago by the editors of *Engineering News-Record* has been widely quoted and copied. Reprints are still available and may be had by addressing the editor.

• • •

Milwaukee moves to protect vital facilities

Milwaukee, Wis. has appropriated $200,000 to be used for local emergencies growing out of war conditions. Part of the fund is to be used for the protection of three water department units, two booster stations and a main filtration plant. Fencing of the properties, erection of floodlights and the employment of guards on a 24 hour basis will be started immediately.

Wide World Photo

Sabotage Safeguards for Water Supplies

GENERAL

Assign responsibility for carrying out the program to a competent individual or small committee.

Formulate a plan of procedure—and execute this plan as quickly as possible.

Check the affiliations and attitudes of all water department employees.

Instruct all employees to report all incidents that depart from normal routine.

Confer with local police, state police, National Guard and other protective agencies concerning special problems.

Create an adequate reserve of supplies, repair and emergency materials.

Provide standby power facilities and otherwise insure functioning of vital equipment in case of emergency.

SOURCES OF SUPPLY

Bar visitors and fishing in the vicinity of dams and intakes.

Provide extra lights at intakes, and consider plans for the use or installation of supplemental intake facilities.

Supplement existing telephone or wire communication systems to isolated points with radio and personal messenger service.

Establish a patrol system along aqueducts and other structures, paying particular attention to vital points such as meter and valve control stations.

Prohibit parking at all times on stretches of road which pass near dams or aqueduct lines.

Restrict airplane operations in the vicinity of reservoirs and dams.

Minimize identification of access manholes and shaft entrances to tunnels and aqueducts.

TREATMENT PLANT

Bar all visitors from waterworks properties.

Consider the use of fence enclosures.

Make frequent inspection of operating equipment, automatic devices, valve mechanisms and standby equipment.

Increase the frequency of water sampling and analysis to insure prompt determination of contamination.

Frequently examine chlorinating equipment and supplies of chlorine.

Maintain an adequate reserve of treatment chemicals.

DISTRIBUTION SYSTEM

Complete all improvements essential to good service requirements.

Install additional valves so that sections of the system may be isolated without major shutdowns.

Interconnect the grid system so that all areas can be served from two or more points.

Provide industrial areas with adequate capacity mains for processing uses and fire demands.

Augment service and maintenance crews, and provide special training for emergency needs.

Compiled a year and a half ago by the editors of Engineering News-Record and published in the July 18, 1940 issue, this check-list has useful application today.

Tallest stack toppled

A large brick stack at the Clipse Works of the Atlantic Refining Co., Franklin, Pa., was recently demolished. The 76-year-old plant was abandoned about four years ago and final demolition is now nearing completion.

It is believed that this brick stack was the largest of its type in the United States. It was built in 1916, and was 310 ft. high, 83 ft. in circumference at the base, and 15 ft. in diameter at the top. Explosive experts used 30 lb. of dynamite in four preliminary blasts to weaken the foundation, and in the final blast 50 lb. was required to bring down the structure.

New Jersey acts to stop Raritan River pollution

A survey of pollution in the Raritan River, just completed, shows that industrial wastes dumped into the river each day had jumped more than 50 percent in the last four years. According to the New Jersey Department of Health, the average yearly flow of the Raritan just below its junction with the Millstone River at Manville, N. J., was 700,000,000 gpd, while the summer daily average was 400,000,000 gpd. This average dropped to about 37,000,000 gpd last summer, when it was observed that 23,000,000 gallons of industrial wastes and 3,000,000 gallons of sanitary wastes were discharged into the river daily just above the head of tidewater at New Brunswick.

As a result of the survey the New Jersey Department of Health has laid down a policy of strict enforcement of health laws and regulations to stop the pollution in the Raritan River valley.

So far municipalities and industries have spent about $5,500,000 to construct treatment plants and it is estimated that at least $1,500,000 more will be necessary for additional treatment plants to take care of industrial wastes.

JOBS OF THE WEEK

ORDNANCE PLANT, Morgantown, W. Va.
E. I. du Pont de Nemours & Co. of Wilmington, Del., have been awarded a contract to design and construct a chemical products plant at Morgantown, W. Va., costing about $15,000,000. This is the third unit awarded by the War Department at this location.

POWER HOUSE SUPERSTRUCTURE, Fort Peck, Mont.
Fegles Construction Co. of Minneapolis, Minn., was lowest bidder for constructing the power house superstructure, surge tank building, installing penstocks and butterfly valves for Fort Peck Dam Project at a cost of $3,407,026. U. S. Engineers, Kansas City, Mo., took bids.

ALUMINUM REDUCTION PLANT, Los Angeles, Calif.
P. J. Walker Co., Los Angeles, Calif., will construct an aluminum reduction plant at 190th St., Western and Normandie Aves., near here for Defense Plant Corp., Washington, D. C. Estimated cost is $5,000,000. Structural steel contract awarded to Bethlehem Steel Co., Los Angeles. H. T. Cory, is supervising engineer.

HYDRAULIC TURBINES, Washington
Newport News Shipbuilding & Dry Dock Co., Newport News, Va., has been awarded a contract by the U. S. Bureau of Reclamation, Denver, Colo., office for constructing three hydraulic turbines for Grand Coulee Dam Power Plant. Contract price is $1,900,000.

AIRPORT, Waco, Tex.
J. W. Bateson, Fort Sill, Okla., was lowest bidder for constructing an airport at Basic Flying School for U. S. Engineers, Galveston, at cost of $1,856,580.

AIRCRAFT REPAIR SHOP, Ogden, Utah
Robert E. McKee, Los Angeles, Calif., was lowest bidder for constructing an aircraft repair shop when U. S. Engineers, Los Angeles, Calif., opened bids. $1,029,700 was lowest bid.

SEWAGE TREATMENT PLANT, New York, N. Y.
E. W. Foley, Inc., Brooklyn, N. Y., has been awarded a contract by Department of Public Works, New York, N. Y., for constructing 4 and 5, Twenty Sixth Ward sewage Treatment Plant. Work includes structures, equipment and piping and will cost $2,064,472.

HOUSING, Cleveland, O.
Maurice L. Bein, of Bridgeport, Conn., was lowest bidder when Cleveland Metropolitan Housing Corp., Cleveland, O., opened bids Dec. 9, for Outwaite Housing Project, Number 2. The low bid was $4,943,000. Project is being financed by USHA. Small, Smith & Reed, Cleveland, are architects. John Paul Jones, and Cary & Miller are engineers.

BRIDGE, Washington, D.C.
Diamond Construction Co., Washington, D. C., was lowest bidder on constructing Bridge No. 3 to War Department building at $765,150 when Bureau of Public Roads, Washington, opened bids Dec. 11.

SHIP BUILDING PLANT, Sparrow Point, Md.
Irwin & Leighton, Philadelphia, Pa., was lowest bidder at $750,000 for constructing ship building plant additions: including fifteen miscellaneous buildings, shops, locker buildings, warehouses, office and railroad siding for Bethlehem Steel Co., Bethlehem, Pa.

WAREHOUSE, Joliet, Ill.
Sanderson & Porter, New York, N. Y., have been awarded a contract by the War Department, Washington, D. C., for constructing ten additional warehouses at Elwood Ordnance Plant. Estimated cost is $700,000.

BAYOU SORREL LOCK, Louisiana
Austin Bridge Co., Dallas, Tex., was lowest bidder at $700,179 for constructing foundation and masonry for Bayou Sorrel Lock, East Atchafalaya Basin Protection Levee on Plaquemine-Morgan City Line Route, Intracoastal Waterway, Iberville Parish, about 15 miles from Plaquemine, La. U. S. Engineers, New Orleans, took bids.

BEACH BRIDGE, New Jersey
Ole Hansen, of Atlantic City, N. J. was lowest bidder for constructing a Beach Bridge, on Route 56 Absecon Blvd., Atlantic City, at $1,167,013. New Jersey State Highway Department, took bids Dec. 12.

FLOOD PROTECTION WORKS, Illinois
U. S. Engineers, Louisville, Ky. awarded contract for flood protection works, Cache River Diversion, Unit 1, Mound City to Stiers Brothers, Construction Co., St. Louis, Mo., $543,089.

NOTE—Additional bidding and contract news on over 300 projects large and small appear in the Construction News sections beginning on page 123.

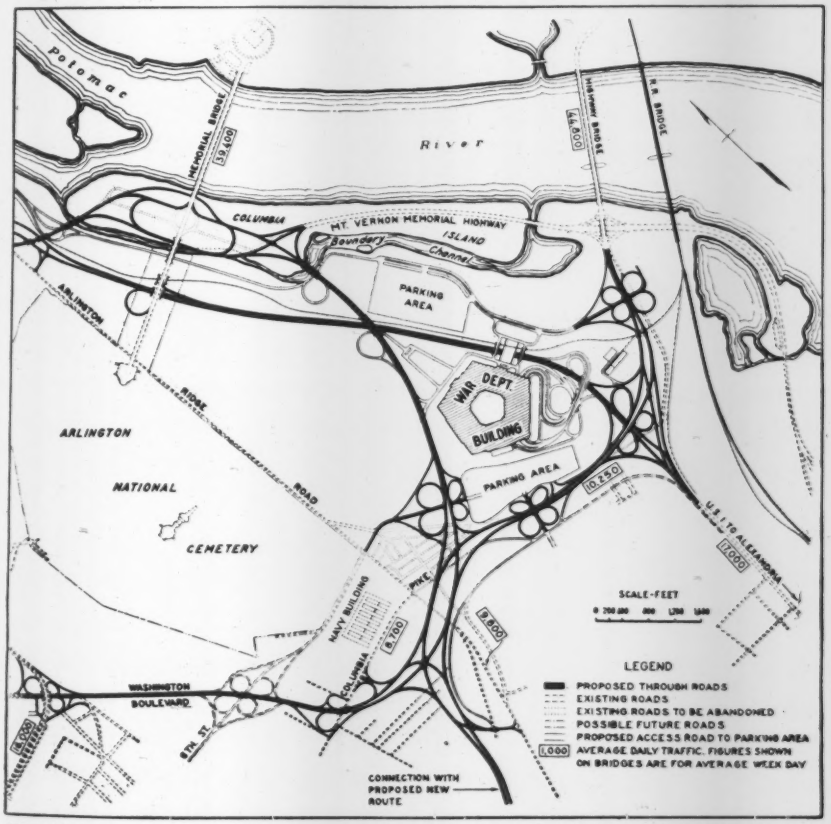
Elaborate access roads planned for Washington

Two major road jobs in the Washington, D. C., area have been announced, both aimed to alleviate the serious traffic problem which will be created when the new War Department building on the Virginia side of the Potomac is completed next year. Both projects are to be financed from funds included in the new emergency highway appropriation. The new building will house 20,000 workers and will be in an area already congested with vehicular traffic.

In Virginia, the Public Roads Administration and War Department engineers have designed a $7,000,000 15-mile system of one-way express highways to connect the new building with four major routes coming into the area from Virginia and with the bridges over the Potomac into Washington. The system, shown on the attached map, will include 19 overpasses, one of them a three-level crossing. Construction will be handled by the Public Roads Administration.

On the other side of the river, the District government has completed preliminary plans for a 4,000-ft. elevated highway along the riverfront in the Georgetown section of Washington. Construction is expected to start in the spring. The $2,200,000 project, which is included in the Washington traffic plan announced last spring will involve three types of construction. At the western end an interchange structure connecting with the existing Key Bridge will be of reinforced concrete. Along K St., an industrial street carrying truck and railway traffic, the structure will have to be of steel because of the limited space available for columns. At the east end the elevated road will return to grade at a recently built overpass carrying K St. over Rock Creek Parkway. Here it will be of concrete construction with stone masonry facing to conform to the Rock Creek Drive landscaping.

Theory behind both of these programs is that the increased traffic resulting from expansion of the federal departments into Virginia can be handled by existing bridges if the approaches are improved.



Location of main routes to serve new War Department building on the Virginia side of the Potomac River, and connect with existing main highways and bridges.

• • •

Pennsylvania Turnpike tunnels guarded

Special details of Pennsylvania state motor police and Turnpike Commission guards have been placed at the seven tunnels of the Pennsylvania Turnpike to prevent any attempt to sabotage this vital highway link with East-West highway travel. The announcement was made by Thomas J. Evans, maintenance chief of the Pennsylvania Turnpike Commission.

Louisiana court frees $1,168,622 road fund

The Louisiana Supreme Court has reversed a Baton Rouge district court decision, thus freeing $1,168,622 of highway funds tied up by litigation since November 1940.

The lower court had granted a preliminary injunction restraining the use of the money in a suit brought by several state taxpayers. The sum involved had been transferred to the highway fund by a 1940 resolution of the state board of liquidation. The plaintiff had asked that this resolution be declared unconstitutional, since the fund represented motor fuel taxes collected under an act of the 1936 legislature placing the fund in the public welfare department. In issuing the injunction restraining the expenditure of the money by the highway department, the lower court held the conversion unconstitutional.

A legislative act in 1940 permitted such a conversion to be made of the gas tax funds by the state highway commission and the supreme court held that this act nullified the previous law passed in 1936.

• • •

New England construction speeded up by Army

All construction activities by the U. S. Army, under the supervision of Lt. Col. S. W. McIlwain, First Zone Constructing Quartermaster, covering New England, have been greatly speeded up to meet the increased requirements essential to prosecution of the war. Work on all types of construction have been put on a 7-day week, 24-hr. per day basis.

All officers and civilians employed on construction work and administrative work in connection with the projects have been instructed that they must be ready to work any time during the day or night, and on 24-hr. shifts, if necessary.

• • •

Half million recommended for Alaska highway

The Appropriations Committee of the House has recommended that $500,000 be granted to carry out construction of the Palmer-Richardson Highway in Alaska, and that the cost limitation of the project be advanced from $1,500,000 to $1,800,000.

Alaska road officials advised the Appropriations Committee that increased prices and unexpected additional work made the extra cost unavoidable.

In addition to the half-million dollar road fund recommended, the committee also recommended an additional $1,305,000 for Army construction at Sitka, Alaska.

OBITUARY

LIEUT. COL. C. N. IVY, U. S. Army Engineers, died on a visit to Washington, D. C., on Dec. 11, at the age of 50. A native of Andrews, Ind., Colonel Ivy graduated from Purdue University in 1916, and entered the Army by way of the Indiana National Guard. He was commissioned a lieutenant in the engineer corps in 1918, and after the war was assigned to river and harbor work. Colonel Ivy was one of the first engineer officers to arrive on the Fort Peck, Montana project, where he was stationed until a few months ago prior to a transfer to Ft. Belvoir, Va. Toward the last of his service at Fort Peck he served as district engineer.

RICHARD C. SMITH, 58, former professor of structural engineering, Tufts College, Mass., died at North Andover, Mass., on Dec. 13. He was born in England, and after graduation from Tufts in 1906, taught there for 12 years. In 1918 he joined the staff of the Mead Morrison Co., Boston, and for a time represented that organization in Montreal, Canada. Later he was connected with the Johns-Manville Co., at Asbestos, Que., having retired on account of poor health in 1933.

WILLIAM A. STANTON, 45, highway engineer, died at Waco, Tex., Dec. 4. Mr. Stanton was formerly district engineer of the Arkansas Department of Highways at Batesville, Ark. Recently he accepted a position with a Texas firm and moved to Waco.

GEORGE D. WILLIAMS, 68, superintendent of public works in Cleveland Heights, Ohio for 30 years, died Dec. 5. Mr. Williams was previously engaged as a civil engineer in Cleveland.

HENRY MORGAN PENDLETON, retired vice-president and director of Merritt-Chapman & Scott Corp., New York City, died Dec. 15 at Westerly, R. I. Mr. Pendleton was 69 years old. He had been associated with the Merritt-Chapman & Scott Corp. until ill health forced him to retire five years ago. In 1923 he was elected vice-president and director. Mr. Pendleton's home was at North Stonington, Conn.

JAMES W. BENNETT, 75, of Oklahoma City, Okla., died recently. He was formerly superintendent of the waterworks of that city and was chief engineer during its construction.

FREDERICK GOTTSCHALK, 77, civil engineer, died recently at Columbus, Neb. He was county surveyor from 1911 to 1939.

GARBER MOCKRIDGE NICHOLS, 54, retired mining engineer, died Dec. 15 at Salt Lake City, Utah.

WALTER W. KANE, assistant city engineer in charge of the bureau of surveys at Newark, N. J., and a municipal employee since 1895, died Dec. 15 at Newark. Mr. Kane was a member of the New Jersey Board of Professional Engineers and Surveyors, and the New York Engineers Club.

WILLIAM BAKER LANDRITH, 85, who supervised the New York Barge Canal while deputy state engineer, died Dec. 9 at Schenectady, N. Y.

Little Rock Engineers award 1,000th contract

The Little Rock District Office of the U. S. Engineers last week let its 1,000th contract, according to Lt. Col. E. F. Kern, district engineer. The contract was awarded to the Chernus Construction Co., St. Louis, Mo., for $64,477, which provides for the clearing of 1,700 acres of land in the Blue Mountain Dam reservoir area in Yell County.

The Little Rock Engineer District was established July 1, 1937, and since that date has let contracts totaling about $14,000,000, thirteen of the contracts have been for $100,000 or more.

CONTRACTS AND CAPITAL

ENGINEERING CONSTRUCTION awards for the week, $66,966,000, are 13 percent higher than a week ago, but are 49 percent lower than in the corresponding 1940 week.

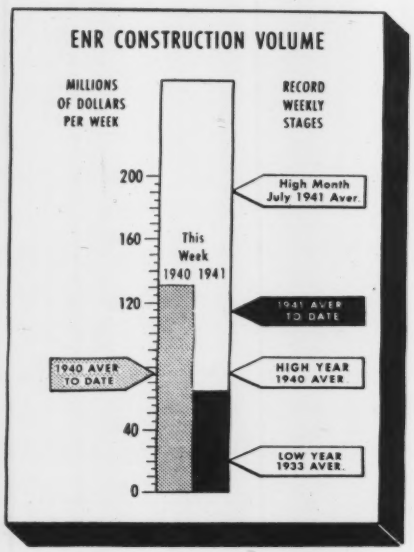
The increased volume of public buildings brings public construction to a level 88 percent above a week ago and is responsible for the gain over the preceding week. Public awards, however, are 34 percent lower than a year ago. Private construction is off sharply, 77 percent under last week, and 84 percent lower than last year.

The current week's awards bring 1941 construction to $5,818,529,000, an increase of 49 percent over the $3,911,902,000 reported for the 51-week period last year. Private construction, $1,172,099,000, is up 2 percent compared with a year ago; and public construction, $4,646,430,000, is 68 percent higher as a result of the 145 percent gain in federal work.

In the classified construction groups, gains over the preceding week are in public buildings, waterworks, and sewerage. Increases over the 1940 week are in waterworks, sewerage, and unclassified construction.

New capital for construction purposes for the week, $5,069,000, is 13 percent lower than in the week last year. The week's new financing is made up of $4,594,000 in state and municipal bond sales, and $475,000 in corporate security issues.

New construction financing for the year to date, $6,324,725,000, is 63 percent above the $3,883,841,000 reported for the 51-week period last year.



CONTRACTS

(Thousands of dollars)

	Week Ending Dec. 19 1940	Dec. 11 1941	Dec. 18 1941
Federal	$69,864	$18,240	$43,497
State & Municipal	21,942	14,119	17,311
Total public	$91,806	$32,359	$60,808
Total private	39,329	26,706	6,158
TOTALS	$131,135	$59,065	$66,966
Cumulative 1941 (51 weeks)			$5,818,529
1940 (51 weeks)			$3,911,902

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1940 51 weeks	1941 51 weeks
NON-FEDERAL	$1,601,880	$1,373,607
Corp. Securities	380,062	357,569
State & Mun.	574,194	432,957
U.S.H.A. loans	218,704	30,299
R.F.C. loans	195,920	288,842
R.E.A. loans	40,000	100,500
Federal Aid—Hwy.	184,000	163,000
FEDERAL	$2,281,961	$4,951,118
TOTAL CAPITAL	$3,883,841	$6,324,725

FHA MORTGAGES

	Week Ending Dec. 14 1940	Dec. 6 1941	Dec. 13 1941
Selected for appraisal (Titles II and VI)	$20,203	$23,114	$20,267*
Cumulative 1941 (50 weeks)			$1,376,541*
1940 (50 weeks)			$1,226,395

* Subject to revision.

ENR INDEX NUMBERS

		1913	1926
Index Base = 100			
Construction Cost	Dec. '41	266.16	127.94
Building Cost	Dec. '41	216.37	116.06
Volume	Nov. '41	282	124

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Suspension Bridge Stability

Sir: The article on "Suspension Bridges and Wind Resistance" by the staff of Modjeski and Masters in your Oct. 23 issue is an illuminating and useful contribution. Of particular interest are the notes on Roebling's anticipation of the problem, also the authors' suggestions of preventive measures including counterweighted cable stays with damping elements. The writer made a similar suggestion to his staff in 1938.

As a further contribution to this symposium, the writer presents the following partial list of preventive, remedial and emergency measures for meeting the problem of aerodynamic instability of bridges:

Methods of Prevention:

1. Avoid the use of solid-web stiffening girders.
2. Avoid designs with low stiffness coefficients (vertical and torsional; main spans side spans, and towers).
3. Provide an open width or openwork construction in the floor cross-section adjacent to the inside face of each stiffening girder. (Patent pending.)
4. Provide wide horizontal ribs (or sidewalk brackets) projecting outward from the stiffening girders. (Patent pending.)
5. Provide longitudinal diagonal stays near each end of the span adjacent to the towers (patented), also longitudinal midspan braces.
6. Provide transverse diagonal stays between cables and girders in the planes of the suspenders at quarter points or other points of the span. (Patent pending.)

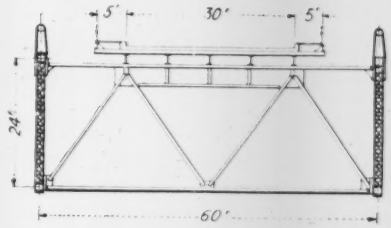
Remedial Measures:

1. Provide longitudinal diagonal stays near each end of the span adjacent to the towers (patented), also midspan braces.
2. Provide transverse diagonal stays between cables and girders in the planes of the suspenders at quarterpoints or other points of the span.
3. Provide streamline fairing for the outer faces of the stiffening girders.

Emergency Measures:

1. From points of the span, suspend submerged horizontal plates for damping.
2. Load the windward edge of the roadway with trucks or other loading to shift the axis of gravity windward.
3. Rip up the sidewalks inside of the girders to permit equalization of air pressures.

The design of the Tacoma Narrows Bridge prepared by Robinson and Steinman in 1929-30 for the Tacoma Chamber of Commerce had open sections adjacent to the inside faces of the stiffening trusses (see accompanying illustration) and for that reason alone, if for no others, it would have been of assured aerodynamic stability.



Bridge cross-section with open areas between deck and stiffening trusses for aerodynamic stability.

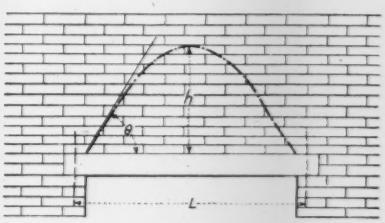
D. B. STEINMAN
Robinson & Steinman
Consulting Engineers

More About Brickwork

Sir: I would like to make some short remarks to the interesting paper of E. E. Seelye "Brickwork as seen by the Engineer."

Although brickwork is a really excellent material and proved since the time of Babylon, it is often used without the necessary knowledge and carefulness. The unfavorable combination of exterior masonry bearing walls with interior reinforced concrete slabs and columns, a weak bond in faced walls—a header every sixth course only—an insufficient foundation and a lack of expansion joints are the most causes of cracks.

On the other hand some good qualities of brickwork are not taken in the right consideration. There is, e.g., the capacity of blank walls to carry over loads by forming internal arches. The old masters knew this and used it.



The calculation of brickwork especially lintels has to take care of this capacity. Calculating the load from a blank wall on a lintel we have to consider therefore only the load below the parabolic break line. The angle changes in accordance with the material: usually 60° for cement mortar and 75° for lime mortar. Hence $h = 0.43\ L$ and $0.93\ L$ respectively. The moment for free supported lintels are therefore:

$M = 0.45 w d L^3$ for cement mortar
$M = 0.097 w d L^3$ for lime mortar
w = unit weight of brickwork
d = thickness of the wall

A partial end restraint, allowable by use of cement mortar, reduces the moment.

For bigger spans we have to pay attention to the deflection of the lintel. If the deflection is too big we can observe cracks above the lintel exactly in the parabolic form mentioned before. But cracks beside the support are possible only on especially bad conditions.

OSKAR SCHREIER
Civil Engineer,

Time Needed for Redesigns

Sir: The article "Designing to Save Steel" by Arthur H. Brewer in the Nov. 6 issue was most timely and summarized very well the methods of saving steel in both concrete and steel structures. The crux of the whole matter, however, is not a knowledge of the methods whereby one is able to make designs using less steel. What the structural engineer lacks is sufficient time to study the design. When it is necessary to get a design out in a hurry the designer will use larger sections and place steel in places where a little study will show that it is not required. Almost all of the structures built now are being put up in a tremendous hurry and there are probably many of them that the designers themselves know to be overdesigned. It is the same old story of the bottleneck in man-power. The situation will probably correct itself because as the supply of steel becomes less, the number of structures to be built will be fewer. Thus engineers will have more time to make comparative designs.

M. S. KETCHUM
Assistant Professor of Structural Engineering
Case School of Applied Science
Cleveland, Ohio

EDITORIALS

VOLUME 127 NUMBER 25

December 18, 1941

WAR AND CONSTRUCTION

WHEN THE HISTORY OF THIS WAR is written, its most stupid performance will be set down as the Japanese bombing of Pearl Harbor. For it brought the United States into the war with a determination and singleness of purpose superior to that with which any nation—even Britain—entered it. What might have taken months to accomplish in the slow-acting incubator of democracy was hatched by the first bomb blast into an expanding force that will grow in these very same months into the most destructive war machine this world has ever known. Complacency, bickering, self-satisfaction, isolationism, cross-purpose—all of the faults of our defense effort thus far that have been so advantageous to Hitler and his puppets—disappeared in the smoke of our planes and ships lost in Hawaii. Born to one hundred and thirty million Americans was the will to win—quickly and completely. And to the several millions of these same Americans who compose the nation's construction industry came the realization that their achievements in building for defense during the past eighteen months—achievements unequaled in the entire history of construction in this country—were only a fair beginning.

Building for defense is a thing of the past. The construction industry's new standard must be emblazoned "building for battle." There is a great difference. Time was short. Now there is no more time. If a bomber plant was built in six months, it must now be built in three. If a dam or a dry-dock was completed in the record time of twelve months, half that period must be the goal for the next ones.

To meet such demands the construction industry has more resources than it realizes. Behind it is a conditioning period in which organizations have had a chance to form, to experiment, to develop personnel, to gain experience. Instead of 40, or 80 or 96 hours a week, there are 168 hours that can be worked; and the men to man the extra shifts will appear, for the construction task is the basic one before ships or guns or planes can be produced. Last year over five billion dollars was spent on civilian construction; this type of activity can be halved if war demands require it. Last year we built nearly everything to peacetime standards; in the interests of winning the war such standards can be lowered if quicker results are thereby assured. Only a relatively small part of the construction industry worked itself to the limit in building for defense. In building for battle, the remainder of this great construction force will come into effective action.

The die is already cast for the months ahead. It is more for war, less for essential civilian needs, and none at all for peace and the pursuit of happiness. And just as the brave construction men on Wake Island dropped their tools to help the Marines defend one of our Pacific outposts, so will the construction men at home place their full energies at the nation's disposal. Theirs is the task of building factories, power plants, housing, roads, airfields, cantonments and shipyards faster than they have ever been built before. There is no reason to doubt that it can be done.

There's a Difference

IT IS TOO SOON to attempt to single out the cause of the collapse of the Hartford Bridge. Investigations are under way, but until the wrecked steelwork and pile supports are raised and examined an important basis for judgment will be lacking. It is not too soon, however, to take issue with statements that the failure indicates that bridge designing practices are advancing too fast. Just because the Hartford Bridge establishes new span lengths for plate girders and because one of the spans collapsed during construction is not adequate justification for charging over-bold design. This was not a structure failure, but an erection accident. It can also be said that the collapse is not an indictment of our ability to erect such long girders, or even of the ability of a specific contractor to erect them. Such accidents happen to the best of contractors and demonstrate little more than that a particular method of erection was faulty in some detail. There is room for argument as to whether or not suspension bridge design practices advanced too fast for a proper appreciation of aerodynamic forces, but until a long girder bridge falls after it has been completed, there is no ground for similar argument in this field. A girder span just as long as the 270-ft. span that fell at Hartford safely carries traffic at Cleveland. And a girder span 54 ft. longer than the 300-ft. Hartford center span has been in service for five years in the Mangfall viaduct in Germany. On the record, long-span girder bridges are not under indictment.

Meeting Urgent Power Needs

THE MANNER in which engineers of the Tennessee Valley Authority have organized their operations to produce the maximum amount of power in the shortest possible time is a notable example of the value of engineering skill in our economic system. Today, the ability to save time by knowing how to do a job becomes a great national asset. The background of TVA experience, which indicated that high-head plants on the tributary streams call for smaller structure and smaller control and power units than are required for the same output from low-head plants on the main river, pointed to high-head plants for quick production of power; and knowledge of the hydraulics of streamflow demonstrated that storage reservoirs high up on the tributaries, by increasing the low-flow, would make possible increases in the capacities of all plants below, or at least an increase in their firm power output. If storage and high-head plants could be combined, so much the better. Finally, because high-head plants lend themselves to division of construction operations, which then can be carried on simultaneously, the time of completion can be cut considerably as compared to a low-head plant where the work is largely centered in a great dam. These are the elements that are combined in the TVA emergency programs as described in this issue. Added to a speeding up of earlier programs, the combination makes one of the most notable engineering and construction operations of our time.

Prefabricated Concrete

THE BASIC IDEA underlying precast concrete is not new but the quality of the product and the technique of putting together precast units have been so greatly improved of late that the term "prefabricated," which manufacturers have introduced, probably is now justified where "precast" was formerly used. Knowledge of how to make stronger, more workable concrete; application of factory technique to mixing and pouring; utilization of vibration; and use of electric welding to form reinforcing cages and later to join the precast member steel to other steel placed in the field, have all been factors in raising the efficiency of the prefabricated concrete structure. Vibration that is something more than a shaking operation is introduced by a machine described in this issue for compacting concrete in forms in a casting yard. The high-frequency impact used in this machine has such an effect that side forms can be stripped from the units immediately, and it makes it possible to reduce the water content of the mix to very little more than is needed for actual hydration of the cement. With these facts on improved methods in mind, it is noteworthy that manufacturers are planning to extend prefabrication in the concrete field, including the making of considerably larger-sized units. It may also be noted that the continually increasing premium on speed in building construction offers an enlarged opportunity for these new developments in prefabricated concrete.

Acres of Loess

MORE THAN TEN YEARS AGO the U. S. Engineer Department at New Orleans sought an asphaltic mixture for revetment work that was tough, flexible and cheap to produce. Like the man in the essay on *Acres of Diamonds*, they did not have to go far from their doorstep to achieve success, because an ideal filler, loess—a wind-blown earth deposit of exceeding fineness composed of uniform-sized grains of silica and other durable minerals—is found on both sides of the Mississippi from Louisiana to Wisconsin. Combined with sand and asphalt in a hot mix, it produced a paving material that proved particularly suitable for the severe conditions to which revetments are subjected. As a result, in the last eight years the U. S. Engineer Department has used over 300,000 tons of the loess-filler asphalt mixture in river revetments. Such a material obviously has a place in many paving projects, and especially airport runways which, like revetments, do not receive traffic kneading and which must withstand moderate shrinkage or heaving of the subsoil. The Baton Rouge airport, now being constructed under the direction of the U. S. Engineer Department and described in this issue, is the first major application of a loess-filler mix to this type of work and as such is worth investigation by highway, airport and perhaps street designers. Not only is loess abundant, widely distributed and cheaply transported, but it is easy to handle and requires little preparation other than drying. Acres of loess actually may prove to be "acres of diamonds."

ENGINEERING NEWS-RECORD
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EDITORIAL OFFICES: 330 WEST FORTY-SECOND STREET, NEW YORK, N. Y.

Fig. 1. Nottely Dam will begin to store water next February, six and one-half months after the start of work.

Emergency Program of the TVA

Theodore B. Parker
Chief Engineer, Tennessee Valley Authority
Knoxville, Tenn.

***Contents in Brief**—Intensive construction of new power plants and storage reservoirs has been undertaken by the Tennessee Valley Authority under emergency authorization from Congress to meet growing power needs of defense industries in the Tennessee basin. Speeding up of the normal construction program of the TVA also has been inaugurated to make the largest possible amount of power available at the earliest possible date. Work now in progress under the emergency authorization is outlined and progress on the projects in the Hiwassee River basin, chief center of the emergency construction operations of the TVA, is given.*

DURING THE PAST TWO YEARS, when the demands for power were increasing rapidly and the demands for aluminum production for defense needs were particularly pressing, the Southeast experienced two of the most severe dry periods of record. It was essential that no plant engaged in the production of defense materials—copper, aluminum, airplane parts or munitions—should have to shut down for lack of power. Stockpiles were dwindling and it became imperative that plants be operated at top speed, drought or no drought, whether secondary power was available or not. The TVA was called upon to supply, from its own system and through its system from other utilities, increasingly large amounts of power in excess of contract commitments. The authority made every effort to supplement the power it could supply with power from other sources, including interconnections with all neighboring systems and also the rehabilitation of a large number of small, inefficient private generating plants throughout the area.

More units needed

Excess deliveries of power to defense industries kept pace with increased tension in the world situation and demands were such that a great increase in power-producing facilities was necessary. The annual load on the system now has reached six billion kilowatt-hours, making it one of the largest systems in this country in volume of power output. More than 55 percent of the total output is to meet the defense load, of which more than one-third is over and above contractual requirements.

The nine multiple-purpose dams built or acquired on the main river now have an installed capacity of 590,000 kw. and ultimately will have an installed capacity of 1,605,500 kw. The same dams provide 6,680,000 acre-ft. of controlled storage above low pool level. To control floods and regulate low-water flow, two large storage reservoirs have been completed, one on the Clinch River and the other on the Hiwassee. These two reservoirs provide 2,385,000 acre-ft. of controlled volume and have an installed hydro capacity of 158,400 kw.

Present power load

Of the six billion kilowatt-hour load on the system, about 400,000,-

000 kwh. represents interchange and purchased power, an arrangement made possible largely due to the fact that as a hydroelectric system, TVA can use off-peak steam generation from interconnected systems, permitting it to store water for later use during peak hours. The recent blackouts indicate that the limit of this interchange and purchase of energy has been reached.

Fig. 2 shows the power loads in excess of contract that are going into the production of metals and strategic materials for national defense. This is secondary power that normally would be shut off during low-water periods, but the continued delivery of which forced the continued depletion of storage reservoirs, so that the system has already entered upon its third year of continued drawdown. Fortunately, unexpected rains during the first week in last July refilled all the main-river pools.

Although the TVA under its normal program now has a gross system capability of 1,092,000 kw., of which 229,000 kw. is steam, the demands for more and more defense power were so urgent that Congress authorized two successive emergency programs during 1941 to speed up power production.

Significance of emergency programs

The first requisite is speed. Economy is also very important, and the suitability of such projects in the ultimate flood-control and navigation program must be considered. The element of speed is emphasized by the fact that, whereas the estimated demand for the latter half of the past fiscal year was 670,000 kw., the actual demand was more than 900,000 kw. Moreover, while it usually takes more than two years to plan and build additional power capacity, it takes only six months to build a typical defense plant such as the new aluminum reduction plant of the Reynolds Metals Co. at Lister Hill, Ala.

Essentials to speed

To insure speedy construction of a power project, the structures should be simple and of moderate size, easily accessible for construction; procurement difficulties must be minimized; and potentialities of existing projects and facilities must be utilized to the fullest extent. It is necessary to avoid large, complicated construction features, prolonged acquisition problems, legal complications as far as possible, and extensive displacement of existing transportation, communication, and power lines.

Acceleration of projects already underway was the first expedient considered. Although the completion date of Kentucky Dam has been advanced a full twelve months, closure cannot be made before the early part of 1944. The Fort Loudoun Dam schedule was advanced 8½ months and two 32,000-kw. units authorized, and still closure is as far off as the spring of 1943. Hydro projects of this type are so involved with seasonal unwatering schedules, foundation uncertainties, extensive relocation problems and adjustments within the reservoir, that acceleration is not only difficult but very expensive. Low-head developments of any reasonable capacity must utilize large volumes of water, requiring huge structures and heavy equipment particularly difficult to procure under present industrial conditions. High head developments on the other hand are better suited for rapid construction in that smaller structures and equipment are required for the same power capacity. Where such developments permit the use of simple structures of known design, and the use of more or less standardized equipment, plans can proceed immediately, procurements be authorized, contracts placed, and schedules prepared on a fairly definite basis.

It was apparent that to secure maximum benefits from new construction

TABLE I—ADDITIONS BEING MADE to Power Plants of the Tennessee Valley Authority Under Its Normal Program and Two Emergency Programs

	Scheduled installation, kilowatts	Ultimate capacity, kilowatts
NORMAL PROGRAM		
Completed projects	1,117,600	1,665,700
Kentucky, 5 units	160,000	160,000
Watts Bar, 3 units	90,000	150,000
Fort Loudoun, 2 units	64,000	128,000
Total, July 30, 1941	1,431,600	2,103,700
FIRST EMERGENCY SUPPLEMENT		
Authorized July 31, 1940		
Cherokee	90,000	120,000
Watts Bar steam, A, B, C	180,000	240,000
Wilson, units 11 and 12	50,400	
Pickwick Landing, unit 4	36,000	
Total first emergency supplement	356,400	
System total, including first emergency supplement	1,788,800	2,463,700
SECOND EMERGENCY SUPPLEMENT		
Authorized June 16, 1941		
Apalachia	75,000	75,000
Ocoee No. 3	27,000	27,000
Nottely	.....	15,000
Chatuge	.....	15,000
Wilson, 13 and 14	50,400	
Watts Bar, 4 and 5	60,000	
Total second emergency supplement	212,400	
System total, including second emergency supplement	2,000,400	2,595,700

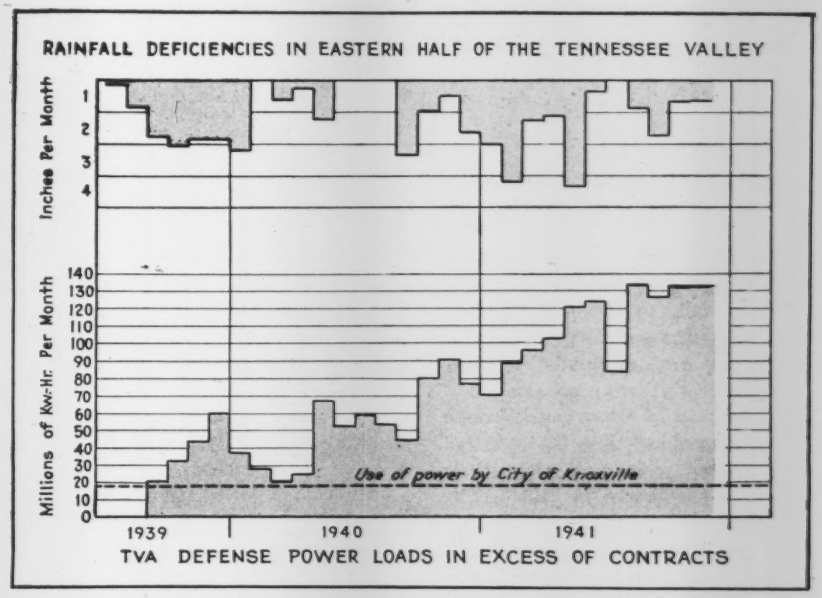


Fig. 2. TVA's defense load has grown enormously since early in 1940. The necessity for continuing to supply secondary power to vital industries, regardless of deficient rainfall, has depleted storage reservoirs far beyond normal requirements. This chart shows only the defense load in excess of contracts. Knoxville's total requirements are shown only for scale.

the fullest utilization possible should be made of existing plants and facilities. This meant that existing storage should be utilized over additional heads wherever available, and that additional storage should be provided for use at existing plants wherever it can be done cheaply and quickly. Storage dams of moderate height, but without generating equipment, can be built with maximum speed. On the other hand, construction of high dams with complicated power plants is inevitably a time-consuming process.

The best opportunities for speedy construction were found on the tributary streams, both for the development of new power sites and for additional storage basins to supplement the low-water flow through downstream plants. Moreover there was ample room to organize these jobs, so that work could be carried on in several elements of the projects at the same time. River diversion problems were also greatly simplified by the control from existing upstream reservoirs and through having smaller drainage areas to provide for.

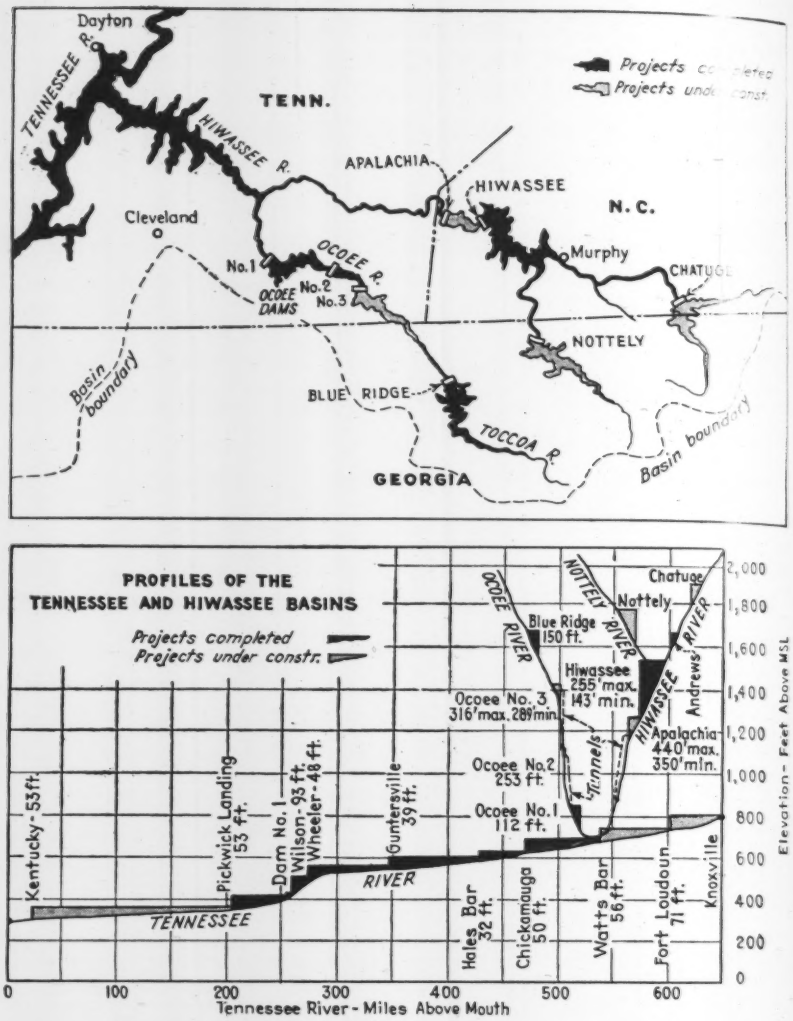


Fig. 3. Projects now under construction on the Hiwassee River and its tributaries are shown in the upper drawing. Below is shown in profile the relation of the Hiwassee projects to those on the main river.

First emergency program

The initial emergency program included Cherokee Dam with 90,000 kw. installed capacity, a new steam plant with two 60,000 kw. units just below Watts Bar Dam, and a total of 86,400 kw. in three new units at Wilson and Pickwick Landing dams. Construction was authorized July 31, 1940. A third 60,000-kw. unit at Watts Bar steam plant was authorized shortly afterwards.

Cherokee Dam on the Holston River provided large upstream storage not only for power but also for flood control on one of the main tributaries of the Tennessee River. Further, the dam need only be of moderate height and the power plant could be designed for standard equipment. The project was so situated as to be accessible readily from all sides.

As evidence of what can be done in record-breaking time by a skilled organization, before and after views of the job are shown in Fig. 4. The job now is two months ahead of what seemed to some to be an impossible schedule. The river has been turned and the closing section of the dam is being completed. The reservoir will be ready to impound the runoff from the coming spring rains. Initial operation of the first unit is scheduled for April, 1942, less than 20 months from the date of starting construction, and yet the job suffered most of the hazards of river construction operations, in addition to the confusion of early priority awards. Perhaps the past drought has not been without some recompense.

The new Watts Bar steam plant along with the five existing steam plants will provide the necessary diversity in capacity. Ultimately, under present authorizations, the gross capability of the system peak will be 411,000 kw. of steam out of a grand total of 1,899,000 kw. steam and hydro. The Watts Bar steam plant alone will firm from 150,000 to 180,000 kw. of secondary hydro energy. At the time the plant was started, procurement conditions still permitted construction in 18 months, mainly by sticking to the selection of major equipment from proved designs offered by manufacturers. The first unit is scheduled to go on the line in February, 1942, and the second unit about a month later.

The two new hydro units of 25,200 kw. each, authorized for installation at Wilson Dam under the first emergency program, are due to go on the line in April and May of this coming year. The third and fourth units for Pickwick Landing, of 36,000 kw. each and authorized at the same time, will be ready in May and June, 1942.

Second emergency program

On July 16, 1941, TVA was ordered to go ahead with the second emergency program. By that time industrial congestion had increased con-

siderably. Steam generating equipment could not even be promised for delivery short of two years from date of order, and low-head hydro equipment would require nearly as long. This put a premium on the development of storage and high-head hydro plants.

Although the largest existing storage was in the Norris Reservoir, there was no apparent way to utilize this stored water to advantage on the lower Clinch River, except at one site of comparatively low head. In the upper Hiwassee drainage area (Fig. 3), however, there were good sites offering opportunities to utilize the storage capacities of both Hiwassee and Blue Ridge reservoirs, and also good sites where additional storage dams could be built quickly and economically. Moreover the development of high heads was possible through the use of long tunnels. The greater the head that could be developed, the greater would be the benefit from stored water. Then too, such jobs could be divided into three sections, the dam, the tunnel, and the powerhouse, and each built by separate crews if necessary. Existing TVA hydro plants in the basin included Hiwassee Dam, with a maximum head of 255 ft., and a useful storage of 362,000 acre-ft.; Blue Ridge Reservoir with a controlled volume of 183,000 acre-ft.; and Ocoee plants No. 1 and No. 2 on the lower Ocoee River with an installed capacity of 36,800 kw. To supplement these developments, it was decided to build the Apalachia project to develop 440 ft. of head below Hiwassee Dam; Ocoee No. 3 project to develop 300 ft. of head below Blue Ridge Dam; and Chatuge and Nottely reservoirs to provide upwards of 400,000 acre-ft. of additional storage above Hiwassee Dam.

Field headquarters were immediately established at Murphy, N. C., and all four jobs are being carried on under the supervision of one project manager. On these projects, $36,800,000 worth of work has to be done in less than two years. Fig. 3 shows the location of the various projects. The following brief descriptions of the principal features may give some idea of the magnitude of the task undertaken, and the necessity for high speed to meet fast construction schedules.

Fig. 4. Progress on Cherokee Dam is shown in these two pictures, one taken in August, 1940, and the other in October of this year, 384 days after the start of construction.

Apalachia

The most difficult part of the Apalachia project is to build 43,000 ft. of concrete-lined tunnel about 18 ft. in equivalent diameter. The tunnel is being built by force account, and the work is being prosecuted concurrently at nine different headings. A surge tank in an open shaft will be built at the lower end. The dam is to be a concrete gravity structure 1,250 ft. long and 150 ft. high from foundation to crest. The power plant will consist of two 37,500-kw. units having an average operating head of 385 ft. The estimated cost is $19,600,000 and initial operation is scheduled for March, 1943, 20 months from the time of starting construction.

Ocoee No. 3

Ocoee No. 3 also has a concrete-lined tunnel, 13,200 ft. long and about 12 ft. in diameter. This tunnel is being built under contract, but the rest of the job is being done by the TVA's own forces. An elevated surge tank, 170 ft. high, and a powerhouse with one 27,000-kw. unit are to be built. Its average operating head will be about 300 ft. The dam is a concrete gravity structure of 610-ft. length and 110-ft. maximum height. The estimated cost is $6,250,000 and initial operation is scheduled for February, 1943.

Nottely

Nottely Dam consists of a wide, impervious rolled-fill core supported by heavy rock shoulders on both faces. It has an over-all length of 2,300 ft. and a maximum height of about 190 ft. A 15-ft.-diameter tunnel has been driven through the rock ridge on the left bank and is now carrying the river flow. Later on the tunnel will be used for the penstock and as part of the outlet works. The control tower will be of conventional circular type with rectangular sliding gates. The spillway will be located on the rock ridge on the left side of the river. No generating unit is to be installed but provision is be-

ing made for a future 15,000-kw. unit. The estimated cost is $4,700,000 and closure is scheduled for next February, just six and one-half months after beginning the work.

Chatuge

Chatuge Dam is a rolled-fill earth embankment, about 2,850 ft. long and 140 ft. high. A concrete arch conduit, 800 ft. long, has already been built and is being used for stream diversion. Later a 12-ft. diameter steel penstock will be placed in the conduit for the permanent outlet. The gate control tower for the intake will be about 150 ft. high. The spillway will consist of concrete paving topped with 5-ft. flashboards and located in a saddle to the east of the dam. From the spillway a concrete-lined channel will conduct the waste water to a stilling basin near the river. No generating unit is to be installed, but provision will be made for a future 15,000-kw. unit. The estimated cost of the project is $6,250,000 and closure is scheduled for next February, another six-and-one-half-month job.

Significance of power program

Nottely Reservoir will have 176,700 acre-ft. of controlled volume, and Chatuge 226,500 acre-ft. Both projects will affect the flood-control reservations established for the Hiwassee Reservoir, and there is the possibility that its useful power storage may be increased. Because of the time required for water released from Blue Ridge to reach Ocoee No. 2, the two developments cannot be peaked simultaneously during low-water periods without wasting water. Ocoee No. 3 will have sufficient pondage to correct this condition, and will thereby increase simultaneous peaking capacity at the Ocoee River plants by the installed capacity at Blue Ridge, which is rated at 20,000 kw. when the reservoir is full. The total effective addition to the system capacity will therefore be in the nature of 47,000 kw.

The normal construction program of the TVA, as scheduled July, 1940, included a total installed capacity of 1,431,600 kw. and provided 812,000 kw. of firm power during dry years and 1,038,000 kw. of continuous power during average years.

The first emergency supplementary program added 356,400 kw. of installed capacity and 270,000 kw. of firm power to the program, consisting of those previously scheduled projects that would be in operation on the completion of Cherokee construction. Upon the subsequent completion of the Kentucky and Fort Loudoun projects, the Cherokee low-water releases will add even more firm power to the system, increasing the system primarily to 1,083,000 kw. continuous power and the average year power level to 1,330,000 kw.

The second emergency supplementary program adds 212,400 kw. of installed capacity and 129,000 kw. of firm power during dry years and 109,000 kw. of continuous power during average years to the TVA.

The TVA board of directors is composed of David E. Lilienthal, chairman; Harcourt A. Morgan, vice-chairman; and James P. Pope. Gordon R. Clapp is general manager. The author serves as chief engineer in general charge of the planning, design and construction activities; in immediate charge, respectively, are Sherman M. Woodward, chief water control planning engineer, George R. Rich, chief design engineer, and Arthur L. Pauls, chief construction engineer.

TABLE II—PROGRESS ON THE MAIN ITEMS of the Second Emergency Supplementary Program on the Hiwassee River and its Tributaries

PROJECT	FEATURE	TOTAL QUANTITY	PROGRESS TO DATE	COMPLETED PERCENT
Ocoee No. 3	Tunnel	12,991 lin. ft.	2,000 lin. ft.	15
	Cofferdam.		First stage completed	
Apalachia	Tunnel	42,700 lin. ft.	4,500 lin. ft.	10
	Cofferdam.		First stage completed	
Chatuge	Fill	2,100,000 cu. yd.	1,740,000 cu. yd.	83
	Concrete	26,600 cu. yd.	14,000 cu. yd.	52
	Diversion		Made Nov. 10	
Nottely	Rockfill	698,000 cu. yd.	260,000 cu. yd.	37
	Earthfill	840,000 cu. yd.	560,000 cu. yd.	66
	Concrete	13,500 cu. yd.*	4,000 cu. yd.	29
	Diversion		Made Nov. 14	

* Not including tunnel lining

Fig. 5. Both wings of Chatuge Dam are up to final grade, and now that the river is being diverted to the concrete conduit (shown at the extreme left) work is being concentrated on the central section of the dam. This picture shows the central section and the west wing.

Official Photographs U. S. Navy

Fig. 1. Outer portion of site after diking; drawdown on pool has started, sheetpiling cutoff is being driven.

Navy Graving Dock Built Offshore in the Dry

Capt. E. C. Seibert (CEC) USN
Officer in charge of construction

***Contents in Brief**—After floating dredges had excavated to a 60-ft. depth, the area for a new drydock at a Naval base was completely enclosed by a dike. Pool thus formed was drawn down slowly by deep well pumps while well-points protected slopes. Concrete placed in alternate sections from 25-ton traveling cableways. A new departure in drydock design uses 50 small pump units for unwatering instead of a few large units.*

A GRAVING DOCK, now under construction at one of the Navy's bases includes features of interest not only because of its large size (150x1,100 ft.) and unusual pumping and flooding arrangement but also because it is being constructed "in the dry," using deep wells to control underground water, aided by wellpoints in the side slopes. The use of deep wells in this way is believed to be without precedent in size and boldness of the operation, and bids fair to establish a new mode of attack on graving dock construction problems.

The curved head of the dock is practically tangent to the former beach line while the dock entrance will be out 1,100 ft. where water depth was 18 to 20 ft. when the work started. Thus the dock is being built in what was originally sea area. Protection of the dock from the sea will be afforded by a breakwater 2½ miles offshore.

The underside of the concrete floor of the dock is 60 ft. below M.L.L.W. Above that elevation are sand, silty loam and clay streaks; below it is a 50 to 60-ft. bed of sand, fine to coarse, underlain by a 15 to 20-ft. layer of silty loam and clay streaks, which in turn rests on a coarse water-bearing sand and gravel of very considerable depth (Fig. 2).

Exploratory work

By means of a test pit some 50 ft. deep, sunk near the dock site with the aid of wellpoints; through the use of test pumps; with observations during pumping, of groundwater levels at appropriate locations (using observation wells or pipes driven into the ground and jetted out to free them of earth); and with laboratory analyses of the various earth materials from the site, data were obtained on which to base estimates of the quantity of water that would have to be pumped to dry up the excavation for the dock after its enclosure within a dike. The amount of water that actually had to be pumped in the unwatering operation was on the order of 25,000 to 36,000 gpm, checking closely with advance estimates.

Excavation to the elevation of the underside of the floor, namely, to a depth of 60 ft. below M.L.L.W., was done with a floating hydraulic dredge. During dredging a protective rock seawall (Fig. 2) was placed around the site, except for an opening through which the dredge and other floating equipment could later be removed. After dredging, floating equipment was used to construct a timber trestle entirely around the site of the dock, and from the deck of this structure, 36 gravel-packed deep wells, 30 in. in diameter, were put down with rotary well-drilling equipment.

Pumping equipment

Most of these wells, spaced beyond and around the site of the dock proper, were sunk deep enough to pierce the layer of silty loam and clay streaks some 15 to 20 ft. thick. (In some cases loss of circulating mud in drilling the wells obscured

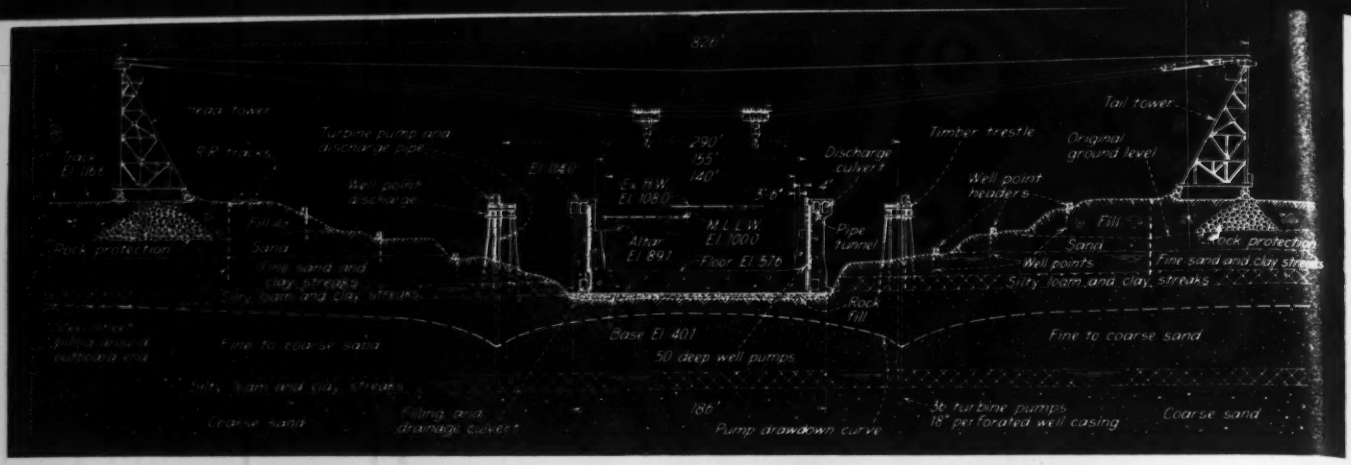


Fig. 2. Section across dock site. Entire area was under water when work started. Note "original ground" level indicated at extreme right.

the data but it appears that 6 to 9 of the wells stopped short of the clay layer). The clay layer was pierced as a safety measure to relieve hydrostatic uplift on this stratum believed to be more or less impervious. This despite the fact that computations indicated a sufficient weight of material above to more than balance the hydrostatic uplift (Fig. 2).

In each well was sunk a 2,000-gpm. pump and submersible motor. The water was piped from the top of each well, through a check valve, into headers, one down each side of the trestle, discharging overboard beyond the bounds of the work.

Dewatering the pool

In addition to the 36 deep-well pumps, two pumps each of 6,000-gpm. capacity were placed on the trestle to pump seawater from the pool enclosed by the dike. Pumping was started on a certain date, and 6 weeks later, the 60-ft. excavation had been completely dewatered. After each few feet of progress in lowering the water in the pool, pumping was moderated or stopped to allow the banks to drain.

Through percolation, the pumping of the deep wells affected the pool level. The well water was tested for salinity from time to time, and generally showed a salt content about one-third that in seawater outside the dike. Even after complete unwatering of the pool there is some salt content in water pumped from the deep wells.

When the trestle had been completed, the floating equipment was removed and the opening in the rock wall closed. Concurrently with construction of the trestle, hydraulic fill was placed along the sides of the rock wall, and a fleet of trucks, loaded by draglines with sand dredged from the borrow areas, aided in completing the rock wall into a dike entirely inclosing the site. This dike completely covers the original rock breakwater except on the ocean end of the dock, where dumped fill was deposited on the inner but not on the outer side of the enclosing rock wall since sea action would have soon carried it away. Finally, as an additional safeguard, a steel sheetpile cutoff wall, with piling all 60 ft. long, and with its top tied by means of rods to the outer rock wall, was driven just inside the rock wall across the outer end. This piling extends across the exposed-to-the-sea portion of the inclosing dike, and returns for suitable distances along both sides of the inclosure, thus almost completely shutting off percolation from the sea.

The maximum rate of pumping from the wells totaled about 36,600 gpm. Five weeks after pumping started, it dropped to 28,000 gpm. at which time the groundwater at the dock site was indicated, by a line of observation wells along the longitudinal center line of the dock, to be 10 to 20 ft. below the elevation of the bottom of the dock excavation.

Other observation wells for studying groundwater action were located in a 4,000-ft. line extending to westward of the dock site. The pumping rate had decreased to about 26,000 gpm. at a time when about two-thirds of the bottom slab of the dock had been poured. These figures indicate that the installed pumping capacity was roughtly double that which pumping experience showed to be necessary.

Wellpoints in side slopes

As the water in the excavation was lowered, wellpoints (usually with 24-ft. risers) were placed, on about 4-ft. centers, to stabilize the banks. In all, about 1,600 points were used, in three lines, in locations as shown in Fig. 2. The wellpoints produced a maximum yield of about 2,000 gpm.

The location and number of wellpoints were not predetermined; they were placed, partly by experiment, where they were found to be needed, and where they produced the greatest yield.

For the best results, the wellpoints had to be gravel-packed, occasionally back-washed with water to keep them clear and productive, and had to be so located that their ends were down to, or extended a short distance into, the various shallow-depth clay strata found in the upper formations. These clay strata acted as floors for collecting the downward percolation through the more-or-less porous materials above.

In putting down a wellpoint, a pipe was first driven by means of a small piledriver rig; this pipe was jetted as driven and cleared by means of the jet. After the pipe had been cleared the wellpoint was introduced, gravel was poured into the space surrounding it, and finally the pipe was withdrawn, leaving the wellpoint in a nicely packed gravel-wall well.

Two relatively small bank slides occurred before the drydock area had been completely closed off from tidal effects. These were not of serious extent, and the areas involved were refilled and stabilized with gravel. Local wet spots in the banks were stabilized by gravel coverings. Gravel thus placed acted in the same manner as a "French drain" and prevented washing away of the finer particles in the banks. Where a leak occurred through the interlocks of the sheetpile cutoff, gravel was banked, with appropriate drain pipes to carry off the inflow.

A study was made of the possible effects of the decrease in hydrostatic pressure in and on the underlying strata, to find whether possible ground settlement might affect nearby

structures. It was concluded that the effect would be minor and would not cause damage to any structures in the vicinity. It is to be noted, also, that upon final completion of the dock and cessation of pumping, the original hydrostatic conditions below ground will be gradually restored.

Concrete placing operations

As soon as the site was dewatered, the bottom was brought to grade, a gravel layer averaging 1½ ft. thick was spread over it, and forms were set for pouring the alternate transverse blocks for the bottom. Each of these blocks is roughly 18 ft. square in section, 186 ft. long (across the dock), and contains about 2,300 cu. yd. of concrete. The vertical sides of the formed blocks were cast slightly concave, thus forming an effective key with the blocks later poured to fill in.

In 48 calendar days after completing dewatering of the dock, the 46th block was being poured, making the total concrete in place, including some portions of side wall sections, about 100,000 cu. yd. This is about 50 percent of the concrete required for the dock.

At the mixing plant, concrete from two 4-cu. yd. mixers goes directly into 8-yd. bottom-discharge buckets on flat cars (three buckets per car), which are spotted by locomotives under the two cableways spanning the dock.

The cableways were chosen and ordered early in the construction program because they would be well adapted to handling the large tremie forms that were part of the original plan. At that time the intent was not to dewater first; concrete forms were to be lowered through the water to the bottom, complete with reinforcing steel in place, for each cross-block of the bottom. Since the later development of a build-in-the-dry plan, the original tremie forms have been cut into smaller pieces, two to a side, and are easily handled and placed by the cableways.

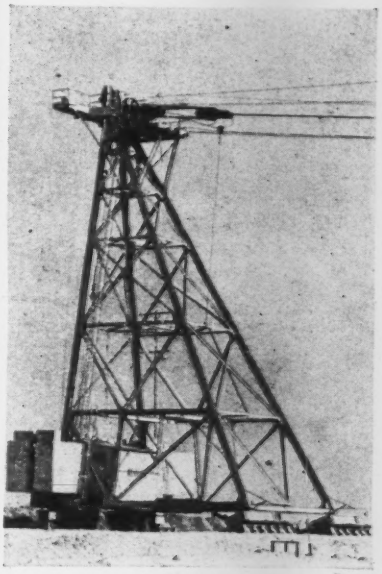


Fig. 3. One of the four traveling towers that support cableways of 826-ft. span and 100-ton combined capacity. Concrete was delivered in 8-yd. buckets handled on flat cars, which were spotted under the cableways by locomotives.

The pipe on the trestle carrying off the discharge from deep-well pumps is utilized as a convenient and economical source of curing water for all concrete surfaces.

Advantages of small pumps

A call for bids on large pumps of conventional type for emptying the dock when in use in docking ships showed that high cost, as well as delayed and uncertain deliveries, made it highly desirable to find some better method of providing permanent equipment. Accordingly a study was made of the use of smaller turbine pumps such as the 36 that have been working satisfactorily in the dewatering operation. It was found that 50 such units (only 14 more than were already on hand, could be distributed so as to gain the great advantage of decentralized flow. Such an arrangement would also afford opportunity for servicing individual pump units without interfering with the function of the dock and would have numerous operating advantages. Accordingly, this plan has been adopted and has been incorporated in final plans for the structure.

The pumps and their submersible motors will go in vertical pump wells cast in the concrete walls of the dock. At their lower ends these wells communicate with a bottom culvert extending entirely around the dock. This culvert is both an inlet and an outlet channel. It receives water from

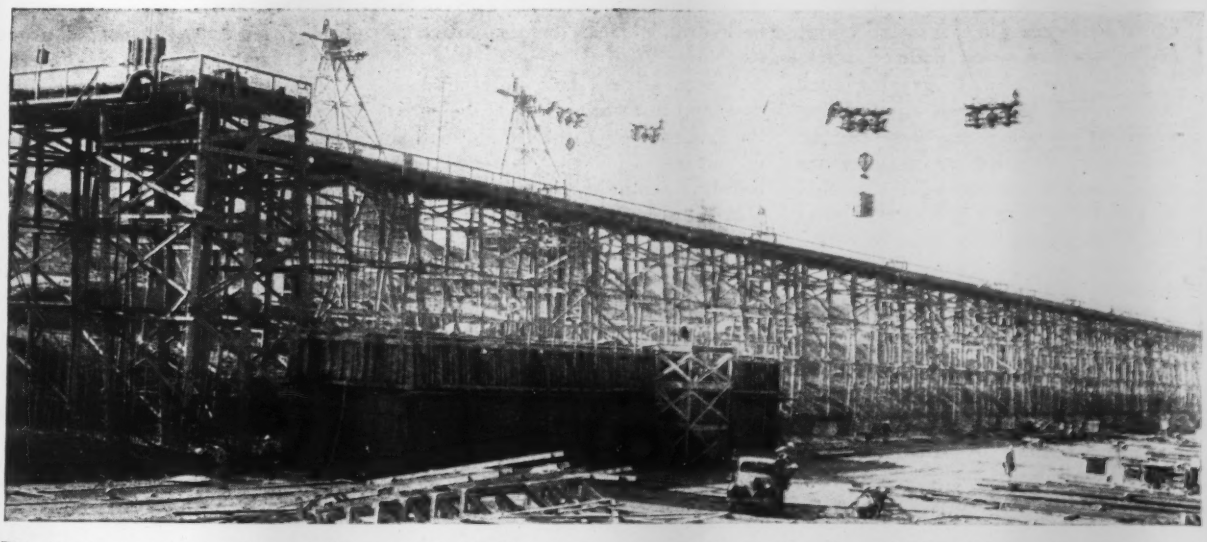


Fig. 4. As fast as section of the concrete bottom were completed, construction of the side walls was begun. Note 8-cu. yd. concrete bucket on cableway. This cableway equipment had been ordered before the plan to build-in-the-dry was adopted, because it was well suited to handling the large tremie forms. This view looks inshore.

Fig. 5. With unwatering complete, alternate bottom blocks were poured.

the dock through drains and connecting passages in the floor and it also has gates on outer ends that communicate with the sea. When these gates are open, sea water passes through the culvert into the dock by way of the drains in the floor. Under this plan, inflowing water is dispersed over a wide area in the dock, thus doing away with strong water currents that might displace blocking during filling.

The steel caisson or gate used for closing the entrance of the dock when it is to be unwatered, will be erected on the dock floor and "launched" when the dock is flooded for the first time. This will occur when the dike is removed from the entrance to the drydock.

Summary

The dewatering scheme of drydock construction used in this instance bids fair to establish a new mode of attack, in applicable cases, to graving dock construction. Although the method involves uncertainties, these can be reduced by devising means to assure a tight and stable inclosing dike and by control of water pressure in deep underlying strata to prevent flow into, and uplift of, the bottom of the excavation. This method, the author believes, can be the means of saving many months in construction time and a very considerable amount of money as compared to the indicated conventional means of placing at least the bottom by tremie. Moreover, building in the dry insures a better quality of concrete.

Before the dewatering method can be safely applied, much advance information must be obtained. Studies that should be made include geological investigation, borings, pumping and laboratory tests of samples to determine flow or percolation rates. If it is determined in any given case that the water can be economically pumped out at a rate faster than the percolation or infiltration rate, the use of the method appears feasible.

Organization

The Navy base establishment, including the graving dock, is being constructed under a cost-plus-fixed-fee contract awarded by the Navy to Guy F. Atkinson Co.—George Pollock Co.; David Root is general manager, Frank Nicol, chief engineer and Harvey Kruse, drydock superintendent. The drydock was designed by the Bureau of Yards and Docks, U. S. Navy Department, of which Rear Admiral Ben Moreell (CEC) USN, is chief. The writer is officer in charge of construction. Lt. W. L. Painter, (CEC) USNR, is head of the construction section of the Navy office and Nathan Karp, civil engineer in the Navy office, has made or checked many of the computations.

How German Military Engineers Rebuilt Norwegian Bridges

IN THE GERMAN MAGAZINE, *Zeitschrift des Vereines Deutscher Ingenieure* of April 12, 1941, some of the methods employed by the German military experts in rebuilding bridges that had been blasted by the Norwegians were described. These included (1) welding of fractured steel parts; (2) building up of wooden cribbing to replace blasted piers; and (3) the use of hydraulic jacks to raise collapsed structures.

Where girders had suffered damage (and this was usually at the ends) the Germans used the simple method of cutting away the damaged part, building a supplementary pier to support the shortened girder and adding small new girders to complete the span. The problem was more complicated in the cases of truss bridges because of the greater spans, the heavier weights and the broken members. In the rebuilding of the Ringebu bridge, containing three truss spans of 160 ft. each and a 19-ft. plate girder, the Germans had to contend with a blown-up pier, which had dropped the adjacent ends of the two truss spans into the water. First a temporary pier was built on either side of the damaged one, using dumped ballast to the water surface and wooden cribbing above that level. The ends of the trusses were then raised to a support on these temporary piers to allow the original pier to be repaired. The Sjoa bridge, with two truss spans, had the top of its center pier blasted away and one panel of steel near one bank badly damaged. A crib support was erected under the damaged panel, the partly destroyed pier built up to the bridge level by means of wooden sleepers and the truss raised by jacks.

The Namsen bridge, with a span of 215 ft. over a river of very rapid flow, was under construction at the time of the invasion. The abutments were built and there were some small concrete bases in the stream to carry a service bridge, but none of the superstructure was in place. The Germans used the bases in the stream to support a temporary bridge of steel girders on wooden piers. The area of the bases was rather small and it was therefore difficult to build piers that were wide enough parallel to the bridge axis to have satisfactory strength and rigidity. The Germans solved the problem by making the piers in form of diamond-shaped rigid frames whose bottom points rested on the small bases and whose top points supported the deck.

Loess Asphalt Mix Used for Army Airport Paving

Fig. 1. Loess filler asphaltic pavement being applied on the Baton Rouge airport runways.

***Contents in Brief**—An asphaltic mixture using loess filler, a development of the U. S. Engineer Department, is getting its first large-scale application for runway paving at the Baton Rouge airport. Widely used on river revetment work, the mixture has shown special properties of flexibility and toughness. A feature of the construction operations is the use of a continuous-mix type central plant for the preparation of this high type pavement.*

A UNIQUE asphaltic paving mixture using loess for filler is finding its first working scale application to airport work at the new Army field at Baton Rouge, La. Loess, a wind-blown deposit occurring intermittently on both bluffs bordering the alluvial valley of the Mississippi River from just north of Baton Rouge to the southern boundary of Wisconsin, and covering a strip 10 to 15 miles wide, is a powder-like material, 80 percent of which passes a 400-mesh sieve. The asphaltic mixture was developed by the U. S. Engineer Department about ten years ago (*ENR*, June 28, 1934, p. 825) and has been widely used by this organization for river revetment protection work where flexibility, toughness and low cost are prime requisites.

A special feature of the air-field construction operations, contract for which is held by the Forcum-James Co. of Dyersburg, Tenn., is the use of a continuous-mix type central plant. This is one of the few occasions on which continuous mixing has been employed for the preparation of a high type pavement. Accuracy and uniformity of mix are secured through volumetric control devices, which have been developed for use on the double-drum, pugmill type mixing plant.

Unusual specifications

In a sense, too, the specifications for the paving are unusual. While they describe the required physical properties of the asphaltic mixtures, it was left to the discretion of the contractor to meet these requirements with any mineral aggregates he desired to use. However, the specifications reveal that mixtures using loess for the mineral filler "may be readily compacted and are capable in their final form of meeting the required physical properties." These mixtures have been tested and used for almost a decade by the U. S. Engineer Department and their formulation represents a vast amount of study and collaboration with engineers of the Asphalt Institute.

In general, the loess filler-asphaltic mixture produces a completed pavement which, by virtue of a predetermined degree of flexibility and toughness, is capable of withstanding moderate shrinkage or heaving of the subsoil without cracking. Experience with more than 300,000 tons of this type mixture on revetment work during the last eight years proves conclusively that this material remains in place without cracking or other deterioration. The belief is prevalent in the New Orleans District Engineer Office that such a mixture has special virtues for airport paving since the

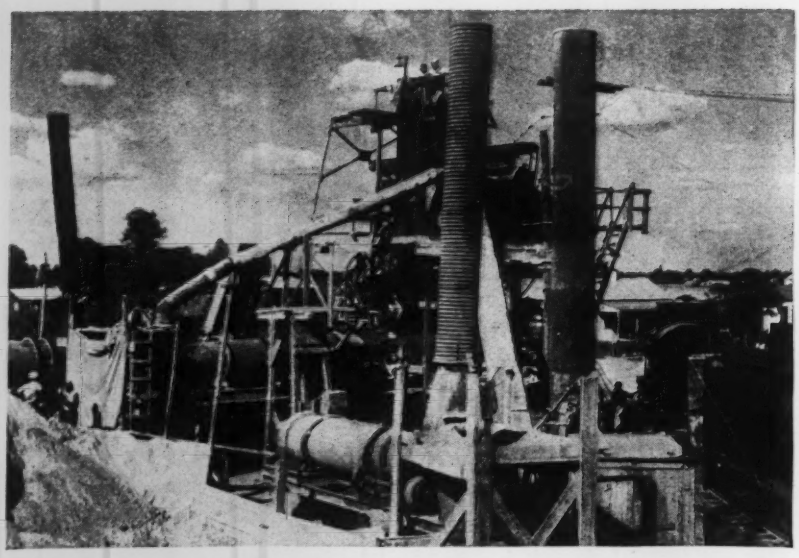


Fig. 2. Continuous mix type central plant for the preparation of the loess, sand and asphalt mixture has an over-all capacity of 120 tons per hour.

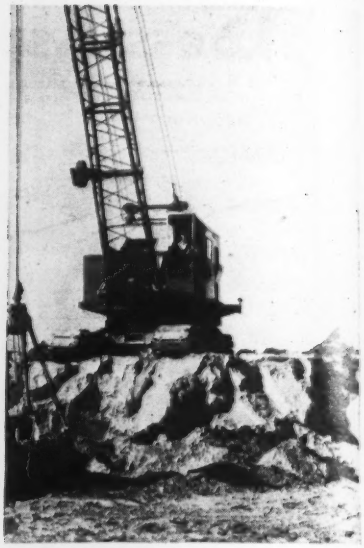


Fig. 3. Powder-like sharp mineral grains of loess give it remarkable stability.

runways do not get the continuous kneading action produced by traffic on roads and streets.

Loess, which is an aeolian deposit composed of silica and other durable mineral grains, provides a filler of such characteristics that the amount of asphalt required for proper binding is somewhat less than would be used for an equivalent mix using rock dust or other filler. Use of a smaller amount of asphalt in combination with the loess filler is expected to minimize the possibility of cracking because of the fact that thermal expansion and contraction of pavement (one of the causes of cracking) is governed more by the thermal expansion of the asphalt cement content than it is by the thermal expansion of the mineral aggregates in the mixture. In this connection the fact should be noted that the coefficient of thermal expansion of asphalt cement is on the order of twenty times as great as that for silica.

Specification requirements

The airport paving specifications call for a mechanically stabilized subbase consisting of the equivalent of a 2-in. thickness of coarse sand thoroughly incorporated with sufficient native soil to form a 4-in. thickness of stabilized base. The base is then primed with coal tar. On top of this is placed a 3½-in. hot-mix asphalt course, which the contractor elected to place in layers of 2-in. and 1½-in. thickness, respectively. A hot mix sheet asphalt wearing surface of 1½ in. completes the paving operations.

For the asphalt base course the limiting percentages of the materials in the mixture are specified to be: 12–18 percent loess (12 percent actually used), 6 to 8 percent asphalt cement (7.5 actually used) and the balance sand. For the wearing course, the mixture is: 18 to 22 percent loess (20 percent actually used), 8.5 to 10.5 asphalt cement (9.5 actually used), and the balance sand. As already mentioned, the use of this mixture and these materials were not mandatory; they were merely advisory and the contractor was restricted only to producing certain physical properties in the finished pavement. The asphalt used is of 85–100 penetration.

Loess is specified to contain not more than 14 percent clay and colloidal matter (all material finer than 0.005 mm.) and must have the following screen analysis: 100-mesh, not less than 98 percent passing; 200-mesh, not less than 90 percent passing; and 400-mesh, not less than 75 percent passing. Natural deposits of loess are such that the contractor has no difficulty in meeting these specifications.

The contractor is using a sand, not more than 3 percent of which is retained on a 10-mesh screen and not more than 2 percent passes a 200-mesh sieve. This material happens to be a byproduct of the gravel pit left over from other operations; it is low in cost and well-suited to the production of a high-quality mixture for this purpose.

Physical properties of the mixture

CONSTRUCTION EQUIPMENT ON THE JOB

At the airport site

One gas-driven 1,500-watt electric generator, trailer-mounted 1,500-watt capacity
One 80-hp. diesel tractor attached to a 12-yd. carrying scraper
One 60-hp. diesel tractor attached to a two-section sheepsfoot roller
Two patrol graders (16-in. blade and 12-ft. blade)
Two rubbered-tired traffic rollers attached to wheel-type tractors of the industrial type
One mechanical subgrader—12-ft. width
Two bituminous distributors — 900 gal. each.
One 5-to-8-ton tandem steel roller
One 8-to-12-ton tandem steel roller
One blacktop paving finisher
Eight 5-ton trucks

At the mixing plant

One 24-in.-dia. by 24-in. hammermill
One double-drum pugmill asphalt plant with volumetric measure control for continuous mix
One 16½-ft. 12-ft.-dia. drumdrier
One 125-hp. boiler, gas-fired
Four vibrator-type screens, 100-mesh
Dust control equipment and fans
Trackage for three cars of asphalt

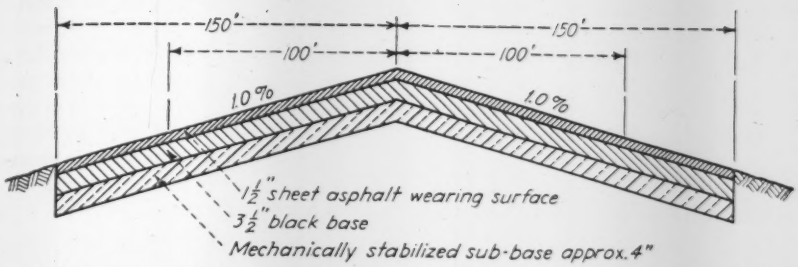


Fig. 4. Typical section of runway pavement. The 3½-in. black base was laid in two courses, after which the 1½-in. wearing surface was applied.

call for the following requirements:

	Base Course	Wearing Course
Stability of cut cores	Min. 350 Min. average 400	Min. 500 Min. average 600
Bends before failure on a 24-in. radius	Min. 3 Min. average 5	Min. 5 Min. average 8

The test for bending consists of subjecting a brick (2x3x10 in.) of asphalt mixture to repeated reverse bends on a 24-in. radius at a temperature of 70 deg. F. The bending is at the rate of approximately 2.4 in. per minute as measured on the radius at the center of the arch. Specimens are prepared in a warm metal mold by carefully troweling the mixture in layers of about ¾ in. Then the finished specimen is removed from the mold and placed in a 70-deg F. water bath for two hours prior to testing. The number of bends required to produce a crack of depth equal to one-half the thickness of the specimen is recorded as the test value.

The mixing plant erected by the Forcum-James Co. is located about two miles from the airport, adjacent to a Louisiana and Arkansas R.R. siding. All materials reach the plant by rail—asphalt is received from a refinery in the vicinity, loess is brought from Tunica, La., some 50 miles north, and sand is obtained 20 miles away. Cost of loess and sand, delivered to the plant, averages about $1.30 a ton.

Continuous mix plant

Plant equipment is detailed in the accompanying tabulation and the general layout is pictured in Fig. 2.

The loess drying and handling facilities include four electrically vibrated screen-units (4x8 ft. each) with 100-mesh openings. Rejected large-size material — comprising about 20 percent of the total—is put through a hammermill grinder and returned to the screen system. Material collected in the dust collectors is likewise returned to the screen for eventual use.

The continuous type pugmill mixer, which has an over-all nominal capacity of 120 tons per hour, is set to operate at a capacity of 75 tons. The mixing cycle (including dry mixing but excluding dumping) is maintained at from 75 to 100 sec. A timing device mechanically controls the duration of each component step of the mixing cycle. The weight of the several ingredients as based upon a 7,000-lb. batch is closely controlled, so that the asphalt cement does not vary within plus or minus 10 lb., while the filler and sand are maintained within limits of plus or minus 35 lb.

Temperatures of the ingredients just prior to their introduction into the mixer box are:

	Maximum	Minimum
Sand	425 deg.	300 deg.
Loess	425	300
Asphalt	325	250

Individual indicating devices are installed to provide temperature data for each ingredient prior to its entering the weigh hoppers. Delivered mixtures are maintained at a temperature of 325 deg. F.

Construction procedure

Rough grading of the airport was started with WPA forces and is being completed by the Operations Division of the U. S. Engineer Department. Some of the grading had reached completion when the Forcum-James Co. started its operations on July 20. To complete the work in the 187-day period called for in the contract, general superintendent G. J. Sander is

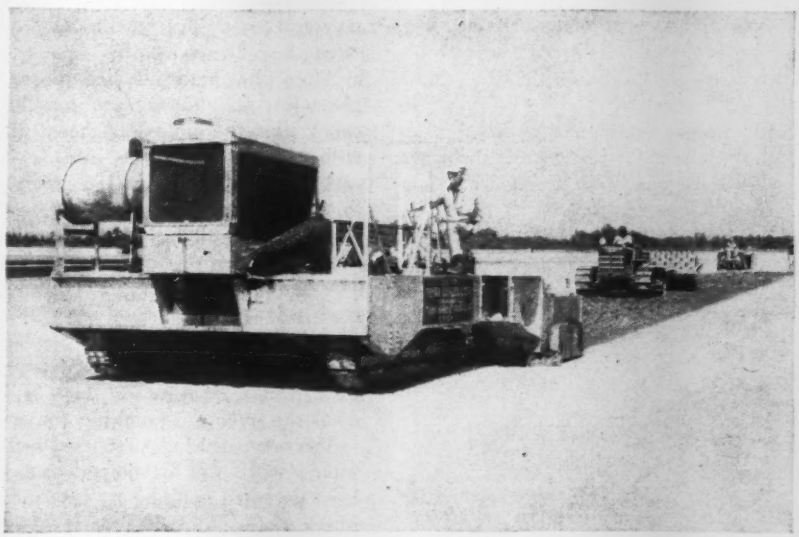


Fig. 5. Sub-base preparation included incorporation of 2 in. of coarse sand in the native soil with a mechanical subgrader, compaction with a sheepsfoot roller and final treatment with a rubber-tired roller.

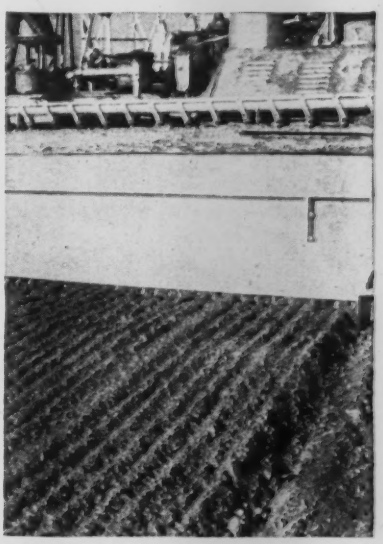


Fig. 6. Condition of soil after addition of sand and treatment with the mechanical subgrader.

employing the equipment listed in the accompanying tabulation, and he is using 200 men working on a basis of two eight-hour shifts, seven days a week.

Field operations are divided into two classifications—sub-base preparation and paving—which are carried out concurrently. Sub-base preparation involves the following steps:

1. Trimming to grade with motor patrol, removing from 0.2 to 0.3 ft. of material. The allowable tolerance is 0.05 ft.

2. Spreading 2 in. of sand with patrol graders.

3. Intermittent mixing of sand with the top two inches of soil; this is done with a mechanical subgrader set to make a 4-in. cut.

4. Compaction with a sheepsfoot roller; this requires from 8 to 12 passes before the roller "walks out."

5. Smooth compaction with a rubber-tired traffic roller of the "wobble wheel" type; four or five passes are required.

6. Blading to grade and final rolling with a steel tandem roller.

7. Application of 0.3 gal. per sq.yd. of coal tar prime. When the ground surface is dusty, water sprinkling precedes the prime coat.

Paving procedures

After the prime coat is dried for at least 48 hours, paving operations are begun. These include:

1. Laying a 2-in. course of base mixture in strips 10 ft. wide using a pavement finisher.

2. Rolling the surface with a 5-ton steel tandem roller.

3. Laying a 1½-in. course of base mixture in 10-ft. strips, these strips overlapping the first course so that the joint planes are staggered.

4. Application of emulsified asphalt with a spreader to provide a tack coat for the wearing course, followed by the laying of the 1½-in. wearing surface in 10-ft. strips. Several days or a week may elapse between the time when the base course is finished and the wearing surface applied, depending on the mixture produced and the sequence of operations at the mixing plant.

5. Final rolling of the surface with the steel tandem roller.

Altogether some 408,000 sq.yd. of runways are being laid. The unit price for the work was $1.23 per sq.yd., which includes final grading, subgrade stabilization, prime coat, base and finish course installation.

For the Forcum-James Co., R. M. Ford, resident manager of Louisiana, has general charge, with project operations under the direction of G. J. Sander.

The work is under supervision of the New Orleans District, U. S. Engineer Department. Lt. Col. C. Kittr[illegible], district engineer. Local inspection at the airport is under the general direction of Wm. B. Smith, principal engineer in charge of the inspection division of the District, assisted by Henry Brandon, associate engineer in charge airport inspection and Brent M. Johnson.

Repairing a Cracked Concrete Flume Without Stopping Water Service

A SERIOUS CRACK in the bottom of a concrete flume was recently repaired under 12 ft. of running water without cutting off the essential supply to an important defense plant. The special feature of the operation was the use of a new type of cement admixture, which permitted the repair to be made under conditions of running water.

The work was done at a large chemical plant, where a concrete flume 20 ft. wide and 12 ft. deep extended through the plant providing an essential water supply for manufacturing operations. The sides of this flume consisted of steel sheet piling and the bottom was a concrete slab. An opening had developed between the piling and the slab in a section where a 24-in. storm water drain passed under the flume. Careful probing with long steel rods through the 12-ft. depth of water disclosed that the crack was about 6 in. wide and 4 ft. in length.

Construction methods

After several previous unsuccessful attempts to effect repairs under the relatively swift flow of the water, the following operations were successfully carried out:

The bottom of the flume and the crack itself were cleaned out by means of water pressure applied through a fire hose, which was fastened along a 4x4 timber and held in position by ropes against the flow of the water. The crack was then probed to eliminate all loose material and slime that might interfere with proper bond. A 4-in.-dia. pipe was extended through the running water into the crack, and soft balls of cement and the admixture were dropped through the pipe and firmly tamped into the crack.

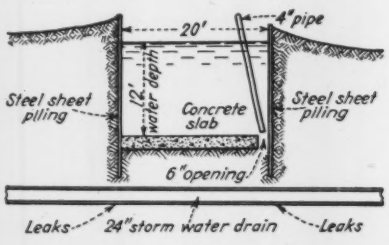


Diagram of the flume, indicating position of the 6-in. opening that was repaired under 12 ft. of running water.

Admixture added

This work was continued until the crack was filled, the pipe being raised as the filling operation advanced. The material used was prepared at the job through the addition of 30 percent by volume of the special admixture to dry cement, resulting in a material that remained unaffected by the flowing water. Previous laboratory tests had indicated a 3,000-psi. strength in 28 days.

After the material had been in place for 24 hours, probing indicated that the hole had been filled with a sound mixture.

A further investigation revealed that the drain running under the flume had settled, leaving openings between some of the pipe sections. The same general process and mixture was used successfully in the stopping of leaks in this displaced drain, in spite of groundwater pressure, and a continuous flow of the drainage over the patching material.

The cement admixture used in this repair work was developed and has been patented by John B. Arpin, Fort Lauderdale, Fla., after years of field and laboratory testing. The repair operations were carried out by Julien Arpin.

Precast Concrete Framing Units For Navy Warehouse

***Contents in Brief**—Dense concrete, accurately controlled under "factory" casting conditions, avoidance of need for shoring under the second floor system and greater speed in building erection, are some of the advantage secured by prefabricating the second floor framing for a two-story building of 170x550-ft. plan, built for the Navy at San Pedro, Calif. Actual cost is some 25 percent under the estimate for cast-in-place construction.*

PREFABRICATED CONCRETE floor joists and beams, some 1,600 of them, have speeded construction and improved the quality standard of a warehouse and mold loft building for the U. S. Navy at San Pedro, Calif. The first floor, and columns and girders for the second floor are of monolithic construction. For the second story, precast units were selected because they could be put up almost as speedily as could timber framing and without requiring the shoring or the delay for curing that would have attended cast-in-place construction.

Since a timber roof system was adopted for this building and the floor surface of the second story is of 2-in. timber planks, it is probable that timber also would have been used for the second story floor joists and beams if the prefabricated concrete method had not been previously used with success on other jobs nearby. The original estimate on cost of construction, however, was based on cast-in-place concrete in the second story floor. This estimate was about $425,000, but with the later modification of plans, particularly the advent of the prefabricated plan for second story floor framing, the cost was reduced to about $335,000.

The essential element in success of the prefabricated program is the use of "factory" methods of manufacture, particularly an efficient machine used in compacting and densifying the concrete in the forms. Other features of the construction program are the methods of handling, transporting, erecting and bonding into a unified structure the individual precast units, some of which weigh as much as 5,500 lb.

A central location was selected in which to make prefabricated units for various building projects of the vicinity. The site is adjacent to a ready-mixed concrete plant, assuring a convenient source of this raw material. For handy delivery into forms, concrete is brought into the casting yard in motor trucks that mix in transit and have means of accurately controlling discharge. These trucks deliver from a platform built alongside the machine on which the concrete forms are vibrated.

Essentially this machine is a platform 3 ft. wide and 30 ft. long on which can be assembled a number of forms, each containing the prescribed reinforcing steel for one of the prefabricated units. Beneath the platform is a motor-driven mechanism to provide impact against the bottom of the platform in such a way as to compact in a highly effective manner concrete dumped into the forms from above. The compacting effect is obtained by heavy hammer blows at the rate of 3,000 per minute on the underside of steel beams that support the platform. As the concrete is thus drawn down into the forms and voids are filled, a battery of hydraulic jacks compress the forms from the side, thus completing a form-filling operation that makes concrete weighing as much as 155 lb. per cu. ft. with a water-cement ratio of only 3.3 gal. per sack. (Absorption tests on this concrete showed that the specimens took up less than 2 percent of moisture when 14 days old, in the standard 24-hr. immersion test.)

In preparation for the discharge of concrete into the forms, the steel reinforcing cages, with 3x4-in. nailing strips bolted on one edge, are placed on steel pallets, one for each prefabri-

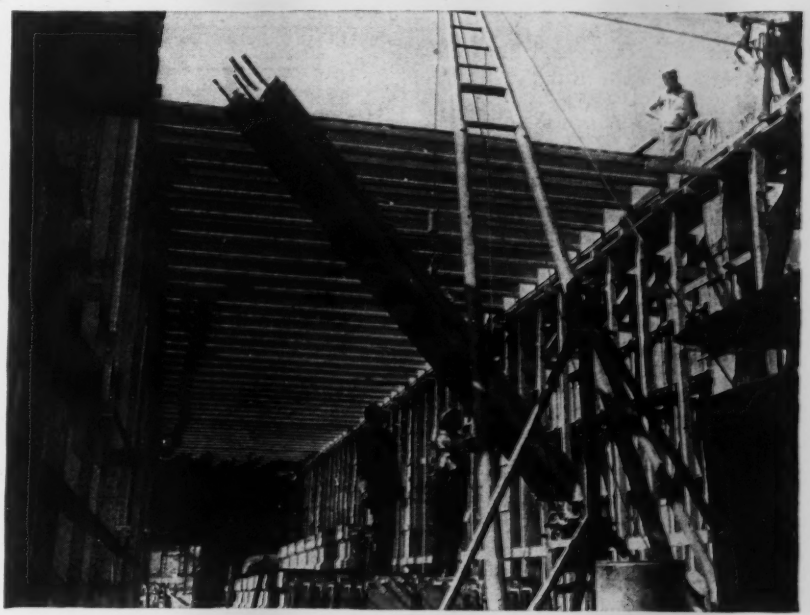


Fig. 1. Lifting a 5,300-lb. precast strut from delivery truck to second story floor.

cated unit, on a platform at the entry end of the casting machine. The pallets, which are 4-in. steel channels, can be of any length up to that of the casting machine. As they are drawn forward on the casting machine table, each pallet passes between the upright steel plates that constitute the sides of the forms. End forms are then put in place and the assembly is ready to receive concrete.

Mixing and placing

For 4x12-in. floor joists, the mix is 1:3½, using sand and No. 3 granite rock proportioned for maximum density. Mixing is such that each rock fragment comes to the forms well coated with the sand-cement paste. When concrete is dumped into the forms and generously piled up on top, the machine is vibrated about three minutes during which time the concrete settles into place until the forms are only about two-thirds full. The machine is then stopped and forms are again overfilled with concrete. After a second vibration period and while the machine is still in motion, any surplus material is scraped off the top of the forms so that each unit will be of prescribed height.

After this second vibration period, the jacks holding the side forms are released and the pallets with the units they carry are drawn forward endwise out of the casting machine onto an adjoining transfer table. Despite the fact that the concrete was poured only a few minutes before, the compaction has been so effective that the newly cast members are stiff enough to retain their shape and the vertical side forms remain in the casting machine, only the pallets and the precast units moving forward.

On the transfer table the units are moved sideways by workmen to separate them so that a curing compound can be sprayed on. A templet is used on each end of the units to make a mortar-bearing surface at exactly the predetermined depth. After 16 hr. they can be lifted by an overhead crane using a central point of support. The units are then stored, awaiting shipment to the job. In seven days the strength averages more than 5,000 psi. and some specimens tested have shown 6,500 psi.

For each 7 joists used on the second floor of the mold loft building, one strut-beam of 12x16-in. section is

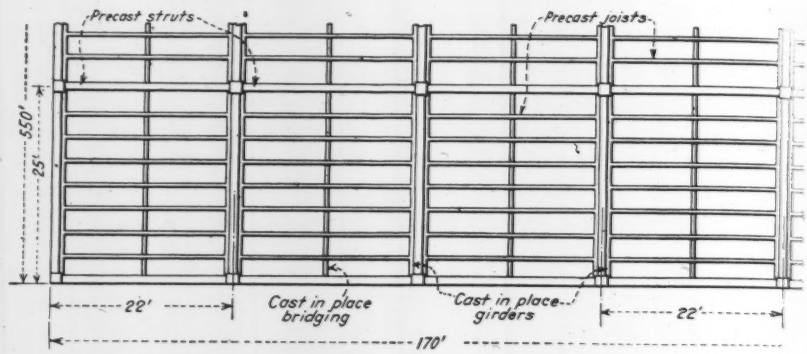


Fig. 2. Portion of the second story floor framing plan indicates how precast struts and joists are combined with cast-in-place girders and bridging.

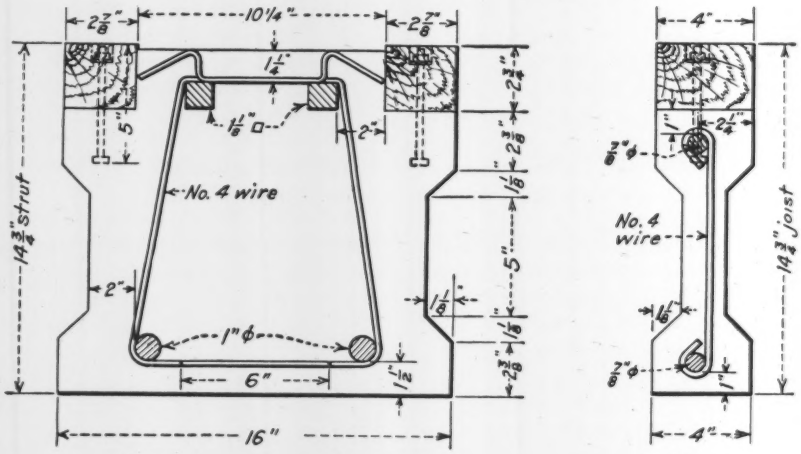


Fig. 3. Sections of prefabricated strut and joist. Prior to casting, reinforcing is welded into a substantial cage to which nailing strips are attached. These units are cast in an inverted position and turned as shown below.

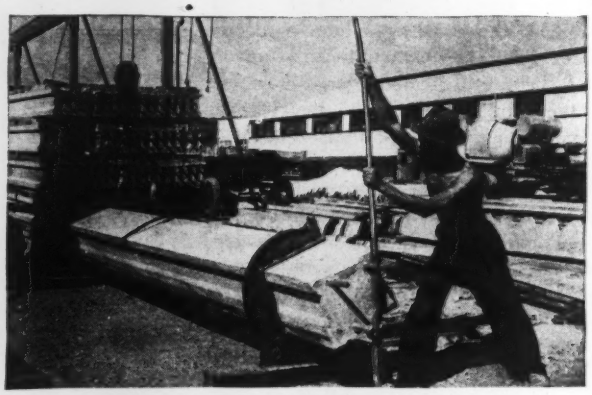


Fig. 4. Precasting operations. Left, a very dry concrete is dumped on the open tops of forms, which are then vibrated. Right, joists and beams, cast with wood nailing strips on the bottoms, are turned over on this pair of rotating collars.

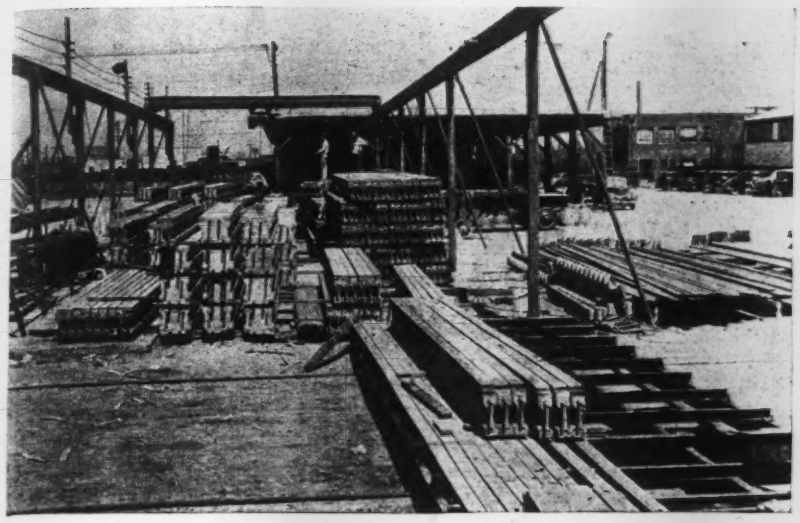


Fig. 5. Precast units are taken from the transfer table (foreground) by an overhead crane to storage piles. Motor trucks drive under far end of the craneway.

required. These beams are cast on the same machine and in exactly the same manner as the joists, using larger pallets and forms. Lengths range from 18 ft. 3 in. up to about 22 ft., the joists weigh 650 to 750 lb. and the strut-beams from 5,000 to 5,300 lb., according to length. Beams and joists are cast with the nailing strip downward and after the concrete has set, are turned over before being stacked in the stockpile. The arrangement and work program in the yard is such that as many as 12 struts and 98 joists have been cast in one 8-hr. shift.

In five weeks the yard manufactured framing for 93,500 sq. ft. of second-story flooring. Work at the building under the prefabrication contract included welding reinforcing steel, placement and removal of forms for longitudinal girder sides and for mid-span bridging.

Delivery and erection

The overhead crane in the casting yard extends, at one end of the stockpile, over a roadway on which the semi-trailer truck with a 31-ft. bed comes to receive its load. Joists and beams are loaded in the reverse order needed for erection with one beam after every seven joists. This semi-trailer with its 17-ton load backs into a bay in the warehouse where bottom forms for the second-story girder have been set up and shored. A 2x4-in. landing strip is provided, its top flush with the bottom of the tee of the girder, for receiving the precast units.

For lifting the units from the truck bed into place in the second floor, a crane was made with a 5-ton winch which was mounted on a truck bed, operated by the truck motor and equipped with a welded steel boom. This crane picks up the individual members by means of a bolt through a hole in the center of the web. This hole is required for the steel rod that ties together the poured-in-place run of bridging at midspan. The working schedule calls for placement of a joist every 2½ min. and the heavier beams in a somewhat longer period.

After joists and beams are placed, the side forms of the longitudinal girders are put in place, leaving the ends of the prefabricated unit projecting into the space to be filled by concrete during the pouring of the cast-in-place girder.

Before the girder concrete is poured, the projecting steel bars from the ends of adjacent units are welded together so that there will be continuity over the point of support. These welds are made with two pieces of reinforcing steel, one on either side, so that there will be no torque in the transfer of stress. After the girder steel is in place and just before concrete is poured, a piece of 2x3 with counter-sunk bolts is placed across the top of the forms at each joist or beam intersection thus to maintain continuity of the nailing strip.

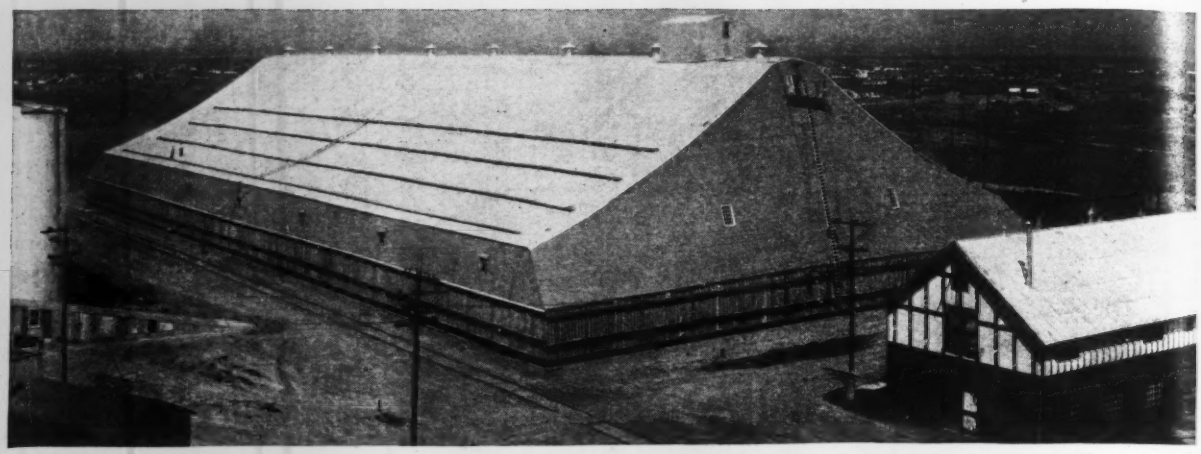
These nailing strips determine the level of the second story floor and as it was desired to keep this within a variation of $\frac{1}{8}$ in. in 6 ft., special attention was devoted to getting these nailing strips as nearly level as possible. Joist and beam deflections were figured and advance allowance was made accordingly. However, because the concrete ran up to and above a strength of 6,000 psi., and the steel also had low-unit stresses, the heavy beams showed less deflection than was figured and while the joist nailing strips came nicely to level, the beams, by their rigidity, made slight ridges in an otherwise uniformly level plane of nailing strips. Until the necessary correction could be made in the casting yard, the nailing strips on these beams were chipped down to prescribed level.

Organization

The building was designed by and constructed for the Bureau of Ships, U. S. Navy. Earl Heitschmidt was architect and Paul E. Jeffers was structural engineer. The general contract was executed by the E. S. McKittrick Co., Los Angeles, and the contract for manufacture and placement of the prefabricated units in the second story by the Wailes-Bageman Co., Los Angeles.

Traffic Paint Substitute

Development of an oil that may serve as a substitute for tung oil in traffic paint, should war conditions shut off the Asiatic supply, is reported in "Highway Research Abstracts" of the Highway Research Board. Quoting from the September issue of *American Miller*, the Highway Research Board states that soybean oil has made an excellent record for durability in ordinary paints and varnishes, but it dries too slowly to serve as a base for traffic paint. Recent research shows, however, that heating the oil with an organic chemical that acts as an "accelerator" speeds up thickening of the oil, which leads to a fast-drying varnish. Addition of a resin or gum and pigment, and of a thinner, forms a satisfactory traffic paint, experimenters think, on the basis of early tests. A large-scale test under service conditions on highways is starting soon. Traffic paints have called for importation of thousands of gallons of tung oil. If the new paint proves satisfactory it will be an outlet for thousands of gallons of soybean oil, and will thus be doubly welcome because the soybean crop has been increasing rapidly in recent years.



Storage for 2,000,000 bu. of grain is provided by this frame building with cable-supported, sheet-metal roof.

Cable-Supported Roof for Grain Storage

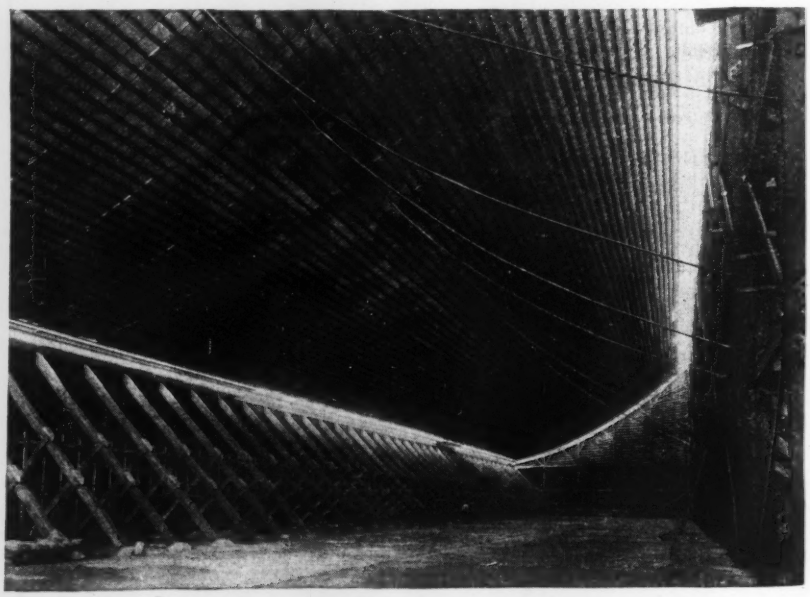
WIRE ROPE SUPPORTS for a sheet metal roof laid on timber purlins is the unusual design feature of a 2,000,000-bu. temporary grain storage house of 180-ft. width recently placed in service at Fort William, Ont., Canada. The 73-ft. wooden towers along the center of the building support the upper ends of the cables and carry a belt conveyor for distributing the incoming grain along the 396-ft. length of the structure.

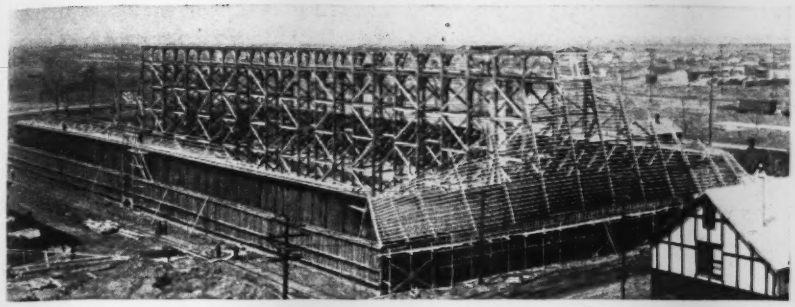
The inside walls, which retain the grain, are 26 ft. high and are built about 6 ft. inside of the 13-ft. outside walls, the space between the inner and outer walls being filled with earth to provide weight in balancing the upward pull of the roof cables. This earthfill also counterbalances some of the outward thrust of the grain against the inner walls. Exterior sheathing slopes from the line of the grain wall to the outside of the earth retaining wall, so that water from the roof and side walls is carried outside of the earthfill.

Along the longitudinal center line of the "house"—as it is known in the storage business—, is a series of wooden towers sway-braced in both directions and anchored to the concrete foundations. They are designed to support the roof cables and resist the uplift due to wind pressures on the roof. The 36-in. belt conveyor, which distributes the incoming grain, is located in the upper part of these towers, and within the tower bases extends a reinforced-concrete tunnel housing the conveyor that handles the outgoing grain. At right angles to these conveyors is another belt in a cross-tunnel, which brings the incoming grain to the boot of a bucket elevator near one end of the house, through which it is hoisted to the distributing conveyor at the top of the towers. A distributing head at the top of the elevator permits filling the nearby area without use of the top conveyor.

Grain is piled in the center until its natural slope gives a height of about 24 ft. at the outside walls, resulting in a depth of about 65 ft. at the center of the house. When grain is to be removed from the house it is discharged to the conveyor through chimney spouts spaced at 36-ft. centers and made in sections 6 ft. long. To keep the grain moving, the top sections are removed consecutively as the level of the grain is lowered. About 65 percent of the stored grain

Catenary roof supports are tied down at 16-ft. intervals by wind cables extending down to the tower columns.





Timber frame, later covered with wood sheathing and prepared roofing closes ends of storage house. Sway-braced tower in center supports cables and carries distributing conveyors.

can be removed by gravity but the rest must be scooped to the tunnel.

The floor of the house is a 4-in. slab of reinforced concrete built on the ground and thickened to 12 in. along the outside, and serves as a footing for the walls and their supports and also as an anchor for the lower end of the roof cables. The roof deck is supported on the ½-in. wire rope cables spaced at 2 ft. c. to c., with their upper ends attached to the central towers by eyebolts on the side opposite the catenary span. The lower ends of the cables pass over a longitudinal timber supported on struts at the top of the 26-ft. interior wall, and extend down to anchors in the concrete slab under the earthfill. Wind cables are attached to the under side of the catenary roof at 16-ft. centers along the middle of the suspended span and anchored to the central towers.

Wood purlins are bolted to the cables at 3-ft. centers and over these is laid a 14-gage metal deck roof, the sheets being lapped and soldered on the horizontal edges and connected by standing joints at the sides of the sheets. No scaffolding was necessary for attaching the purlins to the cables or working on the sheet metal roof. Workmen could move freely over the roof, but several longitudinal walks were laid at intervals on the sloping surface to facilitate the work of this crew.

The sides, ends and the roof over the central tower system is wood sheathed over a timber frame. Wood sheathing is covered with prepared roofing and the walls are lined over the sheathing on the side next to the grain. Ventilators are provided in the side walls and eight roof ventilators are spaced equidistant along the ridge.

The house is designed to withstand a horizontal wind pressure of 30 lb. per sq.ft. and the roof is designed for a 40-lb. per sq.ft. snow load. Exterior walls are designed as retaining walls to take the surcharged grain pressure. Analysis was made for full snow load and wind load with the house filled and also with the house empty. The design was approved by engineers of the Canadian Government.

The building was constructed for the N. M. Patterson Co., Ltd., of Fort Williams, Ont., under an agreement with the Canadian Government to build and lease temporary grain storages on a self-liquidating basis. Fegles Construction Co. of Minneapolis were the engineers and builders, and Walter H. Wheeler of Minneapolis was consulting engineer for the project.

WPA Participation in Airport Improvement Work

Operations of the Work Projects Administration have included the construction of 222 new landing fields, more than 500 miles of runways and the building of 886 new airport structures, according to a report issued by Howard O. Hunter, WPA commissioner, covering a six-year period ending June 30 last. At the present time one out of every three WPA workers is engaged in work of a defense nature.

In addition to the new airports constructed (see tabulation), improvements were made at 360 fields, and about 1,600 buildings were reconstructed or improved.

The airport improvement work carried out by WPA tabulated by states appears in the following sum-

AIRPORT IMPROVEMENT WORK OF THE WPA

(Cumulative through June 30, 1941)

State	Airport Buildings Built	Landing Fields Constructed	Linear Feet of Runways Constructed	Linear Feet of Runways Surfaced
Continental U. S. Total	886	222	2,604,000	283,000
Alabama	32	2	29,900	500
Arizona	1	2	38,700	.....
Arkansas	4	1	23,900	.....
California	105	4	165,400	31,100
Colorado	28	4	135,700	.....
Connecticut	.....	.....	20,200	.....
Delaware	.....	.....	.....	.....
District of Columbia	31	1	23,200	.....
Florida	282	35	193,100	21,900
Georgia	18	15	89,800	20,800
Idaho	8	4	49,600	.....
Illinois	24	3	60,300	.....
Indiana	5	3	66,600	3,100
Iowa	3	1	36,700	21,900
Kansas	6	1	43,500	.....
Kentucky	3	1	40,500	.....
Louisiana	1	3	21,800	.....
Maine	5	13	89,700	2,900
Maryland	2	..	8,800	.....
Massachusetts	5	3	31,700	.....
Michigan	43	17	83,300	31,600
Minnesota	3	2	45,800	.....
Mississippi	15	8	23,100	.....
Missouri	3	3	40,700	.....
Montana	7	5	35,300	.....
Nebraska	11	1	29,200	8,900
Nevada	6	..	14,900	8,200
New Hampshire	6	1	21,800	.....
New Jersey	4	2	25,600	.....
New Mexico	3	2	14,600	4,500
New York	69	11	149,400	7,500
North Carolina	3	1	26,800	31,500
North Dakota	4	..	9,200	12,200
Ohio	5	1	73,000	7,300
Oklahoma	3	1	25,100	.....
Oregon	2	6	67,100	6,500
Pennsylvania	35	12	150,300	4,900
Rhode Island	..	1	2,300	.....
South Carolina	10	5	68,800	.....
South Dakota	11	2	67,200	.....
Tennessee	22	8	63,500	700
Texas	13	4	124,700	18,200
Utah	3	6	77,100	15,200
Vermont	1	1	22,500	.....
Virginia	12	6	11,000	.....
Washington	19	11	69,000	5,000
West Virginia	1	1	27,000	.....
Wisconsin	9	5	64,500	6,400
Wyoming	..	3	11,100	12,200

Absorptive Form Lining Tests at Friant

***Contents in Brief**—The use of absorptive, fiberboard lining on forms for mass concrete has been studied and developed at Friant Dam to the great benefit of the surface finish of the concrete. The need to protect the lining from pressure and excessive moisture and from adhesion to the concrete is reviewed, based on observation during application of nearly 1,000,000 sq. ft. of the lining.*

AFTER OVERCOMING difficulties attending first trials of absorptive lining for forming mass concrete at Friant Dam, technique has been developed and improved until it has been possible to obtain the full benefit that is to be had from use of this material. The absorptive lining has been made to give results entirely satisfactory to officials of the Bureau of Reclamation as well as to the contractor on this dam, which will provide storage on the San Joaquin River as part of the Central Valley Project in California.

Although Friant Dam is not the first structure on which absorptive form lining has been used, yet it has there received its first large-scale test. Nearly a million square feet of this lining was put on the forms at Friant in a period of about a year and a half. This experience has demonstrated that a superior surface finish can be obtained when such a lining is properly used and it has been shown that there are no troublesome requirements or special tools necessary in handling and using the lining, once the needs are understood.

The natural limitations, such as the need for protection from rain in wet climates, must be observed and it is to be remembered that the use of cantilever forms, which do away with ties and struts, greatly facilitates and expedites placement of the fiber liners prior to each pour. Essentials of the observations made on the use of this material during construction of Friant Dam are outlined in the following.

The material itself

The material is a light-weight, highly absorbent fiberboard of sufficient strength to withstand damage when handled with care. In the manufacturing process, the surface against which concrete is to be placed is lightly impregnated with a bituminous paint to hold down the surface fibers and prevent their partial embedment in the concrete. This treatment also slows down the rate of absorption and renders the surface slightly water-repellent.

In general terms, the "minimum requirements" for absorptive form lining set up by the Bureau of Reclamation are that concrete surfaces formed against it must be left hard, dense, uniform in color and texture and free of surface defects such as air voids, sand, streaks, irregularities and other imperfections. Specifications intended to accomplish this, and under which the lining used at Friant was purchased, include provisions summarized in the following:

While having characteristics highly absorptive to air and water, the lining must have sufficient resistance when wet and backed by a rigid wood form to withstand the pressure exerted by fresh concrete (of 4-in. slump) 12 ft. deep, without being deformed to an extent that would mar the appearance of the finished surface. When tested for water absorption, under a specified procedure, the time required for a 4x4-in. surface area of the lining to absorb one half a cubic centimeter of water must not be more than 30 min. nor less than 15 sec.

Quality and appearance of finish obtained with the lining (above) are much better than when ordinary forms are used (below).

Other requirements put upper and lower limits on transverse strength as well as on deflection in a bending test. Tensile strength must be not less than 175 psi., linear expansion must not exceed 0.6 percent and the sheets (which are all of $\frac{1}{2}$-in. thickness) must have the specified length and width dimensions required within a plus or minus tolerance of $\frac{1}{8}$ in. and a thickness variation of plus or minus $\frac{1}{16}$ in. On not more than 5 percent of the area covered by lining may there be remnants left stuck to the hardened concrete after the forms are removed under prescribed test conditions.

As used on the Friant job the lining comes in sheets 4 ft. wide and $5\frac{1}{2}$ to $8\frac{1}{2}$ ft. long, packed in waterproof paper, six sheets to the bundle. This makes a package of 95 to 150 lb., depending on the length of sheets. A package weight convenient for handling is important because several rehandlings may be necessary by reason of the need for protection from moisture. When unloaded from freight cars on the Friant job the packages are stored in weatherproof sheds. From these sheds they are loaded into waterproof skips, which cranes place on the dam.

The cantilever forms used on Friant Dam are unusually rigid, faced with 2x6-in. vertical tongue-and-groove lagging backed with 14-in. horizontal ribs at 30-in. centers. The fact that these forms are of the cantilever type has been an important factor in the success of the absorptive form lining on this job. Since a description of these forms was published in *Engineering News-Record* (April 10, 1941, p. 542), a number of improve-

ments in details have been made, several of which are shown in the accompanying drawing.

In those portions of the structure where tierods and brace pipes are necessary for supporting special forms, the same lining can be satisfactorily used although with somewhat higher cost because of the additional work involved in fitting around obstructions.

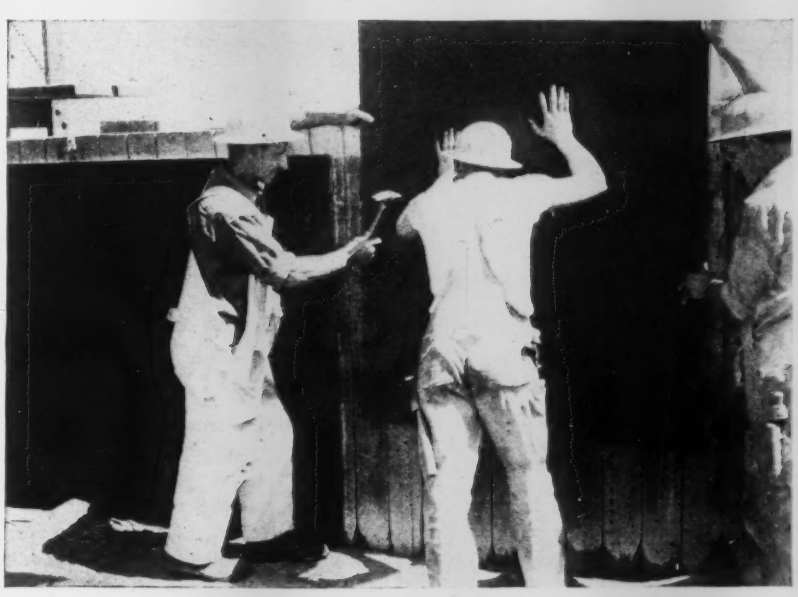
Technique in placement

Crews for placement of the lining ordinarily have consisted of 4 carpenters, 2 helpers and a foreman. Any cutting that may be necessary to bring the sheets to the required length is done in advance and they are nailed securely to the forms with four-penny casing nails spaced at about 12 in. both ways except around the edges of the sheets where the nailing should be on 3 to 6-in. centers. Along the top of each sheet four-penny box nails about 3 in. apart are used in place of casing nails for additional security.

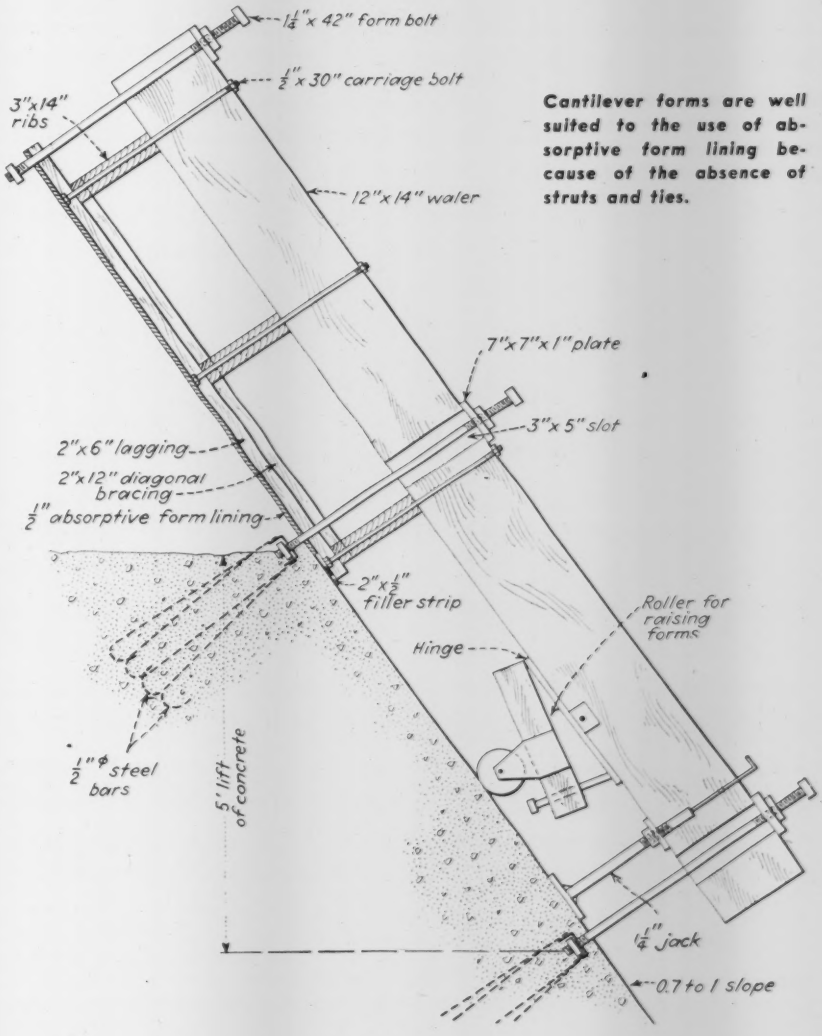
To prevent excessive compression of the lining when form bolts are tightened, a 2x½-in. wood strip, preferably of hard wood, is placed between the bottom of the form (see drawing) and the concrete of the previous pour, while the form is being set in place. The sheets of lining are set so as to lap at least 2 in. over the concrete of the previous lift. These precautions are taken to prevent offsets at the construction joints between successive 5-ft. lifts.

No special tools are required for cutting the absorptive lining; it is worked readily by the carpenter's saw, and brace and bit. To prevent the sheets from buckling as they expand after absorbing moisture from the air, spaces or "cracks" $\frac{1}{16}$ to $\frac{3}{32}$ in. wide are left between adjacent sheets when they are nailed on the forms. These spacings are easily maintained by metal spacers—small sheet metal plates of the proper thickness with projecting points at the corners that enable the plates to be fastened into the wood of the forms by a light tap with the carpenter's hammer. The spaces thus left between adjacent sheets usually close before concrete is placed. If they do not, the resulting concrete fins can be removed easily by light stoning.

It is not feasible to place the absorptive form lining during heavy rains. However, once it has been placed on the forms, lining can be



Sheets of absorptive lining are light, fairly strong and require only reasonable care in placing. The lining is put on by carpenters.



Cantilever forms are well suited to the use of absorptive form lining because of the absence of struts and ties.

Small vibrators are used within 6 in. of the lining; large vibrators are kept at least 1 ft. away. The 5-ft. lifts are placed in 12-in. layers.

adequately protected from rainfall by a canvas cover. Even if the lining does become thoroughly saturated, little or no damage results provided it is dried out prior to the placement of concrete. This has been done occasionally at Friant with the aid of warm air from electric air dryers or air circulated through heated coils, with only the drawback of some delay in operations.

The relation to concrete

The mix and the slump of the mass concrete placed against absorptive lining seem to have little or no bearing on final results so long as concrete is properly placed and adequately vibrated. The procedure at Friant has been to spread the mass concrete in 12-in. layers, five layers to each 5-ft. lift. The maximum time interval allowed between the placing of successive 1-ft. layers is 1 hr., permitting complete consolidation between successive lifts while the concrete is still plastic.

In vibrator operation the practice has been to keep the large vibrators, operated by two men, at least 1 ft. away from the lining, and the small vibrators at least 6 in. away. Use of spades near the forms is prohibited because of the danger of damage to the lining.

Experience on this job put emphasis on a close control of the time elapsing between pouring and stripping forms where absorptive lining is used. When forms are removed within 36 hr. or less, very little sticking of the lining has occurred. Some sticking occurred when the forms were left on for 72 hr., and if left longer than that the sticking was reported as usually excessive, leaving a surface that could be cleared effectively only by scraping. However, this was not always the case and it was suggested that the amount of sticking was influenced by the kind of cement used (whether low-heat, modified or standard) as well as by atmospheric temperatures, etc.

Each sheet of lining can be used only once and thus far there seems to be no value in the absorptive material after removal from the forms. However, the form panels do not have to be oiled, as would be the case if no lining were used, and this item of cost should be deducted from charges against the use of lining.

Conclusion

The following conclusions cover essentials of the practice in handling absorptive form lining as developed at Friant:

(a) Surfaces formed with absorptive lining can be made far superior in appearance and quality to surfaces formed with wood- or metal-lined forms. The use of form lining gives the concrete a finish of pleasing texture, whose surface is extremely hard and free from excess surface voids, sand streaks, and other defects usually associated with the use of wood- or metal-lined forms.

(b) The improved absorptive lining now available is well adapted to heavy construction service if reasonable care is used in handling it and keeping it dry prior to the placement of concrete.

(c) The additional cost that absorptive lining involves is not excessive and is partially offset by the savings in cleaning and oiling of forms, and the filling of surface voids by sack rubbing.

(d) Before the lining is put in place, form surfaces must be reasonably smooth and free from offsets and other imperfections if resulting concrete surfaces are to be smooth.

(e) Forms should be stripped before the concrete is 36 hr. old or the lining will adhere excessively to the concrete.

(f) Concrete should be placed against the lining and properly vibrated in layers not more than 12 in. thick if rock pockets are to be prevented.

(g) The time interval between placement of these successive 12-in. layers of concrete should not exceed one hour under normal conditions, if cold joints are to be held to a minimum.

(h) Horizontal concrete construction joints adjacent to the lining should be thoroughly cleaned prior to the placement of lining on the forms to prevent wetting the lining in the cleanup operations.

(i) Use of absorptive form lining in localities where rainfall is heavy would be successful only if special provision were made to keep the lining dry.

(j) Form lining can be used only once and apparently has no salavage value.

Organization

Construction of Friant Dam is being carried out under contract by the Griffith Co. and the Bent Co., M. H. Slocum, general superintendent. For the U. S. Bureau of Reclamation, John C. Page is commissioner, S. O. Harper, chief engineer, and R. B. Williams, construction engineer at Friant Dam.

Earth Wall Properties And Uses are Tested

Walls of rammed earth are more durable than those made of adobe, and offer many opportunities for further development by the application of engineering methods. This is one of the conclusions reached by the National Bureau of Standards following extensive tests of various types of earth walls, reported in Building Materials and Structures Report BMS78, available from the Superintendent of Documents, Washington, D. C., for 20 cents.

The report also includes information on methods of design and construction relating to adobe, long used in the Southwest, rammed-earth houses that later appeared on the Atlantic coast, poured walls built by early Pennsylvania settlers, the sod cabins of the Midwest pioneers, and the wattle and daub type wall.

The report gives in detail the results of strength, heat-transfer and water-permeability tests on specimens of adobe, bitudobe, monolithic terracrete, terracrete block, and rammed-earth walls.

The methods of test employed were similar to those used in earlier tests to determine the properties of masonry and wood construction, the results of which have been published.

Progress in Highway Research Reported at Baltimore Meeting

***Contents in Brief**—Summaries of the principal technical papers and committee reports presented at the annual meeting of the Highway Research Board are given in the following, which supplements the news report of the meeting published in the issue of Dec. 11, p. 842. Subjects covered are current cement and concrete studies, soil pressures, pavement design and construction, geometric highway design, and roadside development. Notes on other papers and reports will be published in a subsequent issue.*

ACTIVITIES at the 21st annual meeting of the Highway Research Board held in Baltimore, Dec. 2-5, centered around departmental reports of past accomplishments of the board as recorded in its proceedings, but these reports were supplemented by a large amount of new information on current research in highway fields. The departmental reports were the result of a request from the board that each department review those sections of the proceedings that relate to its work for the purpose of compiling therefrom a summary of the major items that still are of value to highway engineers. These summaries are to be compiled in some convenient form for the use of highway engineers.

Cement and concrete

The department of materials and construction devoted its attention almost exclusively to cement and concrete. Temperature and moisture variations in concrete pavements were discussed by F. C. Lang, engineer of tests and inspection, Minnesota highway department, and the effect of calcium chloride on portland cements and concrete was taken up in two papers, one by J. C. Yates, research associate for the Calcium Chloride Association at the National Bureau of Standards, and one on volume changes in cements and concretes by Mr. Yates in association with John Tucker of the bureau staff. This latter paper reported progress in what is essentially a revival and continuation of an extensive study of the effect of calcium chloride on portland cements and concrete begun in 1932. Calcium chloride was found to reduce volume changes (shrinkage) in all cement pastes, an addition of two percent being more effective than one percent. The reduction is due to the property of calcium chloride to retard the hydration of aluminates and keep the hydrating mass more amorphous.

Durability of concrete

Progress reports of studies under the direction of the committee on durability of concrete were limited to one of a subcommittee that has begun a comparison of the relative severity of the freezing and thawing tests as conducted in seven laboratories. Half the test specimens are to be made in the laboratory of the Public Roads Administration and shipped to the cooperating laboratories, and half will be made in the laboratories with materials supplied from a central source. In this way it is hoped to be able to get a comparison of the severities of the test procedure in the cooperating laboratories that will eliminate some of the uncertainty surrounding this type of test for durability.

In another paper on freezing and thawing test procedure, W. E. Gibson, engineer of tests, Kansas Highway Commission, gave details of a test procedure for determining the soundness of concrete aggregates developed at the Road Materials Testing Laboratory at Kansas State College, which, in the author's opinion, is superior to that of the American Society for Testing Materials. The Kansas method does not require quite as much equipment, takes cognizance of pieces of aggregate that are not unsound but that would be so classified under the A.S.T.M. method, and does not require visual inspection of the sample for a satisfactory interpretation of the test results, as is the case under the A.S.T.M. method.

Cofferdams in soft mud

What he characterized as an "approach to the design of cofferdams in soft mud to prevent blow-ins" was given by Prof. D. P. Krynine in a paper presented only in summary form at the meeting of the department of soils investigations. The paper reports a series of laboratory studies made with "soft material" from the deep bottom of the Thames River at New London having a natural moisture content of close to 100 percent of dry weight. Two possible ways in which slumps in the river bottom cause a blow-in were discussed by Prof. Krynine and a formula was proposed for determining the depth to which the sheetpiles should be driven to maintain stability. In presenting his studies, Prof. Krynine stressed the importance of the time element; giving mud time to consolidate around sheetpiles before unwatering a cofferdam helps materially in checking blow-ins.

Soil stress distribution

Much interest was aroused by the emphatic statement of Prof. Krynine in his capacity as chairman of the committee on stress distribution in earth masses, at the end of his report, that literature on stresses in earth masses is too voluminous and contains many repetitions and complicated formulas. He urged the preparation of a brief manual, written especially for highway engineers, that would completely replace this confusing mass of information.

Earlier in his report Prof. Krynine had said that there is no way to compute stresses within an earth mass, that they can only be estimated by considering the earth mass as an idealized body. "Formulas of the theory of elasticity may be applied to earth masses with certain

limitations. Particularly, for computing vertical pressures at a certain depth, such as 50 ft. or more, the Boussinesq formula may be used. For shallow depths, particularly in the case of highway subgrades, the Boussinesq formula does not fit experimental results.

"For computing shearing stresses, elastic formulas alone are available. No other way of doing so has been proposed except some graphical or experimental methods, based, after all, on the theory of elasticity.

"In using 'classical formulas' for lateral pressure, such as Coulomb's or Rankine's, attention should be paid to the fact that these formulas are valid only under the assumptions made in their derivation. Particularly, these formulas cannot be used for flexible walls, for sheet piling, and for bracing of cuts and tunnels. In the province of vertical pressures on pipe culverts, the existing Marston's theory may be considered adequate for all practical purposes.

"In all cases, without any exception, mathematical results obtained by the use of formulas must be checked against sound engineering judgment based on experience which cannot be replaced by theories. Theory and practice should be combined."

Commenting on the inadequacy of information now available to highway engineers, L. A. Palmer said that Prof. Krynine's committee could well make a study of the interaction between a concrete slab and the supporting soil to develop correct formulas. Formulas in most text books are wrong, he added.

Pavement design

Flexible-type pavements were the chief subject for discussion at the design department meeting. In addition to the summary of past papers on flexible type pavements called for by the board, there were papers on load tests on flexible surfaces, by Prof. W. S. Housel of the University of Michigan, on field investigations for flexible pavement designs, by T. A. Middlebrooks and G. E. Bertram of the U. S. Engineer Department, on wheel-load distributions through flexible pavements by Prof. M. G. Spangler, Iowa State College, and on measuring the load supporting value of flexible pavement. by W. H. Campen and J. R. Smith, Omaha Testing Laboratories, Inc. Much of the information in these papers related to airport pavements. Prof. Spangler's paper was a third progress report on a research project seeking to supply fundamental knowledge on the distribution of wheel-load pressures through flexible pavements to their supporting subgrades. The studies gave further substantiation to a finding reported in 1940, namely, occurrence of pressures on the subgrade substantially greater than the tire inflation pressure, a finding that was seriously questioned by some readers of the earlier report.

Also presented at this design meeting were summaries of past studies on rigid pavements and on highway guards.

Expansion joints

Expansion joints are detrimental to concrete pavement built with limestone aggregates, according to the tentative conclusions reached in a study of expansion and contraction joints now in progress in Missouri. Such joints are needed in pavements built with chert aggregates to prevent blowups, but in both chert and limestone pavements they result in increased transverse cracking. Contraction joints, spaced up to 70 ft. in mesh reinforced pavements of limestone concrete, and at 40 ft. in chert concrete, have been found beneficial in controlling cracking. Mesh reinforcing checks transverse cracking and keeps the cracks from opening. This study was reported by F. V. Reagel and Don E. Gotham of the Missouri Highway Department.

Vibration in pavement construction

Tests on two types of vibrators designed for use in constructing concrete pavements were described by H. F. Clemmer and Paul W. Downey of the engineering department of the District of Columbia. Both vibrators are used just in advance of the screed, spanning the full width of the slab. Vibrating blades submerged in the concrete are the active element of one vibrator (Electric Tamper & Equipment Co.) and a horizontal tube, also submerged in the concrete is the effective element of the other (Mall Tool Co.). Test specimens were cast integral with the pavement, all conditions being the same except that no reinforcing steel was placed in the test panels. Higher flexure and compression values were obtained with the vibrated concrete, also greater density and lower absorption. Concretes too harsh to be used without vibrators was made workable with the vibrators and produced no honeycombing; also, higher strengths were produced with lower cement content.

Studies of the amplitude of vibrations in the fresh concrete on the same job in the District of Columbia were made with a special device developed for the purpose. Amplitude was highest in the puddled area just in front of the vibrator but fell off rapidly at a distance from the vibrator, which is considered desirable to prevent over vibration.

Forest highways

Methods used by the U. S. Forest Service in determining highway types in the National Forests were described by Bruce B. Burnett, senior highway engineer of the Forest Service. Peculiar problems that have to be met in forests such as Tahoe in California include the trucking of heavy loads of timber over roads that do not call for high-class surfacing on the basis of traffic. Another problem is movement of sheep and cattle from one range to another without completely tying up traffic on the road.

Geometric highway design

As one of the summaries to be included in the compilation of highway design data being prepared by the Highway Research Board, Joseph Barnett and D. W. Loutzenheiser of the PRA presented a discussion of the published "design policies" of the American Association of State Highway Officials. These relate to highway classification, sight distances, marking no-passing zones, highway types (geometric), intersections at grade, and rotary intersections. Inclusion of most of these standards in the projected Highway Research Board publication was endorsed by Prof. R. A. Moyer, Iowa State College, but he characterized others as substandard with respect to safety provisions, especially the curve standards and intersection designs, and recommended that they be not included without some qualification.

Alignment economics

Studies conducted in Oregon of fuel consumption and time saving in relation to alignment were given in a paper by C. B. McCullough, chief engineer of the Oregon State Highway Commission, which was presented by Prof. Moyer. The tests

were made at constant speed (with compensation for grades) on two types of highway, one an old highway having curvature up to 1,027 deg. of central angle in one mile and the other a modern highway with much less curvature and flatter curves. Savings in time were found to be the principal economies resulting from improved alignment, due chiefly to the fact that fuel consumption increases as the amount of curvature is decreased because higher speeds are possible on such highways. Use of the central angle as an index of the effect of curvature rather than degree of curvature was found to be the best method for evaluating alignment.

Driving practices

A symposium on driving practices by members of the staff of the Public Roads Administration brought out the fact that bridge roadway widths on a 20-ft. roadway should be from 27 to 30 ft. if drivers are not to change their transverse position on the road as they approach the bridge headwalls. Truss bridge roadways should be still wider. Also, according to W. P. Walker, shoulder widths on bridge approaches appear to affect the transverse position of drivers, narrow shoulders resulting in a shift toward the center line.

C. W. Prisk stated that the average driver occupies the left-hand lane for a distance of 604 ft. in passing the vehicle ahead, but if unhindered by other vehicles takes 703 ft. Total distances traversed from the time a driver starts to pass until he is back in line range from 1,200 ft. at speeds from 30 to 39 mph, to 2,000 ft. at 50-59 mph. Long sight distances on tangents are not as conducive to passing as are moderately long sight distances on curved roads where a driver sees no cars in the opposing lane.

Trucks on hills

Checks on the hill-climbing ability of trucks made in an effort to determine the extent to which road capacity can be increased by grade reductions show, according to C. C. Saal, that considerable reduction in the higher grades only results in a minor increase in the speed of trucks carrying pay loads. Grades must be cut to below 3 percent to permit loaded trucks to operate at high speeds. In hilly country the simplest expedient for speeding traffic is construction of extra lanes for slow moving trucks on upgrades. Power input must be doubled to bring truck speeds up to the average on hills, and pay loads must be reduced beyond economical limits to obtain the same objective.

New studies of traffic capacities were presented by O. K. Normann, largely in the form of charts and tables. These were based on actual checks of capacities of two-, three- and four-lane roads under different conditions of traffic. Mr. Normann said that these studies will permit more accurate prediction of when a highway will reach its working capacity, namely, the number of vehicles per hour which can move over it without reduction of the speed below that at which the average driver travels when unhindered by other vehicles.

Traffic studies

Other studies of traffic capacities were given in a paper by Mr. Normann at the traffic department meeting on Friday. Included was a comparison of the divergent results obtained from the application of the several theoretical methods for computing safe spacing on highways with those obtained by actual observation of the spacing of cars at many points and on roads ranging from 2 to 6 lanes in width. Maximum lane capacities were found on two-lane roads.

Crossover distances

Checking driver reactions in crossing from one lane to another as a means for determining what distances should be allowed in geometric design studies were reported by Prof. S. M. Spears, Illinois Institute of Technology. The studies covered many conditions and speeds and gave results indicating that the crossover distance is definitely related to the rate of steering wheel rotation and that this rotation occurs at virtually a constant rate for the majority of drivers, thus making it possible to write a definite law that for 90 percent of the drivers will give results very close to observed results at speeds ranging from 15 to 65 mph.

In discussion, Prof. R. A. Moyer, Iowa State College, raised question as to the need for such an elaborate study to determine the crossover distance because it can be computed mathematically with reasonable accuracy, but expressed the hope that the method of checking driver reactions employed by Prof. Spears would be used to check the adequacy of other elements of geometric highway design that do not lend themselves to mathematical determination.

Roadside development

Assets and liabilities of roadside development were summarized by T. R. Kendall, editor, *Contractors and Engineers Monthly*, who cautioned against over-development of landscaping, especially the spotting of shrubs over grassy slopes making hand mowing necessary where power mowers could be used otherwise. The same point was raised by John Monteith, Jr., of the U. S. Department of Agriculture in his discussion of methods for stimulating the growth of turf. H. J. Neale, in pointing to the cost savings to be obtained by proper mulching and seeding, noted the need for a study by the Department of Agriculture of grasses suitable for highway turf as opposed to forage grasses. Short grasses of little value for forage may be found to be ideal for highway slopes. Mr. Neale also pointed to the advantage of providing for erosion control at the time of construction as a source of large economies.

Overdevelopment of roadside parks as a source of considerable increase in maintenance costs was noted by Mr. Kendall, a view that was supported by Henry J. Schnitzius, Indiana, who gave figures as to the cost of maintaining such parks in his state.

Studies of sodded roadside drainage channels were described by Carl Izzard, of the PRA. Velocities as low as 2 fps, will erode bare earth, but sod will stop erosion at all velocities normally used in side ditches. Recommended velocities for different types of grass cover will be included in Mr. Izzard's paper when published. The most satisfactory type of side ditch is one with a 4-ft. bottom width and 4:1 side slopes. While such ditches cost more than triangular ditches they are easier to mow and give better storage areas for snow. Properly designed sodded ditches will make possible considerable savings in ditch paving.

(Summaries of other papers and reports presented at the Highway Research Board meeting will be published in a subsequent issue.)

Hidalgo-Reynosa Bridge Rebuilt

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***Contents in Brief**—The suspension bridge over the Rio Grande at Hidalgo, Texas, collapsed in 1939 due to the failure of two cables, presumably due to corrosion stimulated by electrolytic action on the cables within the anchorage. The bridge now has been rebuilt with new anchorages designed to prevent a recurrence of electrolytic corrosion. Provision has been made to neutralize induced currents.*

A RECONSTRUCTION PROJECT with many unusual features was completed last winter on the 450-ft.-span suspension bridge over the Rio Grande between Hidalgo, Texas, and Reynosa, Mexico. The work consisted of the construction of new anchorages, underpinning of the Mexican tower pier, placing of new cables, construction of a new American approach span and reconstruction of the suspended span utilizing as much salvage material as possible. The bridge, a private toll structure originally built in 1926, collapsed on Sunday, Nov. 12, 1939, due to cable failure (*ENR*, Nov. 23, 1939, p. 672).

In 1933, the bridge previously suffered an accident due to failure of the pier on the American side caused by a flood. Reconstruction of this pier was completed in 1934 (*ENR*, June 14, 1934, p. 777). The present accident caused no damage to the piers and towers, but it was deemed expedient to underpin the Mexican tower pier while the bridge was out of service to correct possible sources of future trouble.

Traffic was restored within three weeks after the collapse through the construction of a temporary wooden pontoon bridge, which functioned satisfactorily until the new structure was opened to traffic, in slightly less than a year. This same pontoon bridge has recently been placed in service on the San Juan River in Mexico where it forms a link in the new Mexican federal highway connecting Reynosa with Monterrey, Mexico. It will continue to be used until a permanent bridge can be erected at this crossing by the Mexican government.

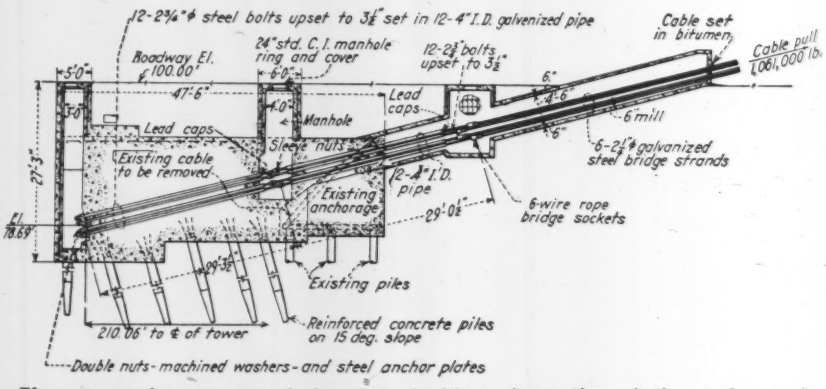
The original Hidalgo-Reynosa Bridge was of the unstiffened suspension type, with parallel wire cables supported by two steel towers on concrete piers with driven piling foundations. It had a center span of 450 ft., and a roadway width of 16 ft. The roadway was constructed of wood planking supported on steel stringers and floorbeams. In order to utilize the undamaged portions of the structure as much as possible the dimensions of the reconstructed bridge were made the same as those of the original structure. The type of construction was in general similar, although major changes were made in the new anchorages and in the type of cables; some modifications were made in the structural details of the floor system.

In the construction of the original bridge, ends of the parallel wire cables were embedded in the concrete anchorage. They were so placed that moisture during wet weather conditions was able to enter at a number of points, the most critical of which were at construction joints deep in the anchorage. Accordingly, the failure of the original cables was caused by conditions particularly favorable to corrosion. The bridge collapsed about thirteen years after the original construction. These favorable corrosion conditions were further complicated by electrolytic action which was particularly acute at the point of failure.

Reconstruction operations

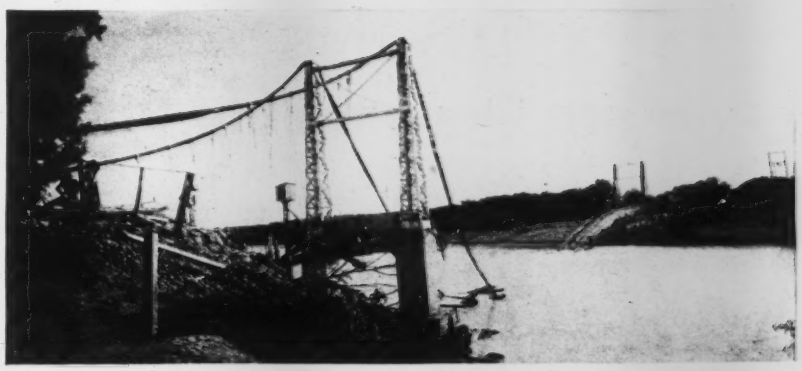
In construction of the new anchorage, special attention was given to preventing a recurrence of both ordinary corrosion and electrolytic action. From above the surface of the ground to the cable anchor plates the cable loads are transferred to $2\frac{3}{4}$-in. round steel bolts upset to $3\frac{1}{2}$-in. at the ends and threaded. These rods carry the stresses along a straight line to the anchor plates. The bolts themselves are not embedded in the concrete, but are placed inside of 4-in. inside diameter galvanized pipes. Complete inspection facilities are provided at the ends of these bolts where they pass through the anchor plate, and also at a midpoint. Provision is also made for the withdrawal of individual bolts in the event replacement ever becomes necessary. Two bolts are provided for each cable.

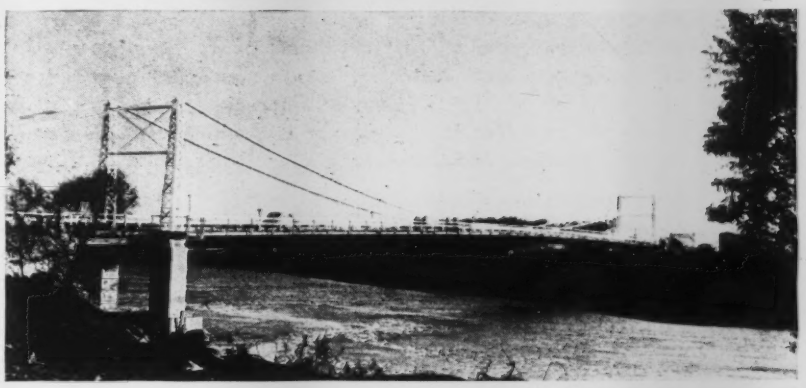
To replace the original parallel wire cables, six $2\frac{1}{4}$-in. galvanized steel bridge strands were utilized in each of two cables. These are socketed in



The new anchorages are designed to facilitate inspection of the anchor rods and their replacement if necessary.

the ends and are of the prestressed type. In installing these cables on the original towers it was necessary to provide revised cable saddles, roller nests, and plates. The bridge structure is suspended from these cables through the medium of rods attached at their upper ends to cast steel cable clamps, and at their lower ends to pins passing through connections to the floorbeams. On completion of the anchorages the erection of the cables and the bridge structure was extremely rapid.





Electrolytic corrosion within the cable anchorage resulted in failure of the Hidalgo-Reynosa Bridge on Nov. 12, 1939. The rebuilt bridge is shown below.

Study of electrolytic action

On completion of the new bridge an extended series of studies was made to determine the presence, if any, of electrolytic currents. As possible sources of induced currents there were the following: a three-phase, 2,300-v. transmission line parallel to the upstream suspension cable and 125 ft. from it; a group of telephone lines, parallel to and 100 ft. downstream from the downstream cable, some with metallic returns and some with one-line earth returns; a radio transmitter of 100,000-w. capacity 1,200 ft. from the Mexican anchorage. A fourth source of current was assumed to be static current picked up from the air.

The tests indicated that there was a difference of potential of 0.1 volts, direct current, with the cables showing a negative charge. It was also found that there was a flow of 40 milliamperes. Readings were taken on each of the six individual cables in each of the two suspension groups, and they were found to vary from 40 to 46 milliamperes flowing in each individual cable on the Mexican end of the bridge. On the American end, readings revealed that electrolytic currents were flowing from each individual cable to the ground at the rate of 25 to 26 milliamperes at a potential of 0.4 volts. The cables were indicated as being negative with the ground positive.

Following these tests it was decided that the static currents flowing from the suspension cables to the ground must be neutralized. Accordingly, a unit was designed and installed for this purpose. It consisted of a two-volt wet-cell battery and a two-ampere charging unit. Current fed into the base was governed by a potentiometer. A milliammeter for adjusting and checking the amount of current being sent into the bridge also was provided. The positive lead was taken to the center of the bridge and was securely fastened to the center point of each individual cable by means of copper ground straps. The ends of each individual cable were grounded by using a No. 6 soft drawn copper wire and copper ground rods, ¾-in. round by 8 ft. long. The grounds for the charging unit and those at each end of the bridge were placed so as to be equidistant from each other.

After the cables were grounded, readings were taken between the cables at mid-span and at the ground. These readings showed that a current of six milliamperes at a potential of 0.1 volts was flowing. When the charging unit was put into operation and the charging current applied at the rate of six milliamperes, it was found that there was no indication of any current flowing from the suspension cables to the ground.

The Hidalgo-Reynosa Bridge is one of the most important crossings on the Rio Grande, connecting Texas state highway No. 66 and the new Mexican federal highway now nearing completion between the lower Rio Grande Valley and the City of Monterrey. The nearest means of communication into Mexico upstream is between Roma, Texas, and San Pedro, Mexico, a distance of 52 miles, and downstream is the bridge connecting Mercedes, Texas, with Rio Rico, Mexico, hence it was imperative that the reconstruction of the bridge be completed without delay.

Because of difficulties encountered and the desire to utilize as much salvage material as possible, the construction work was carried on by forces of the Valley Bridge Co. of Hidalgo, Texas, owners and operators of the bridge, under the supervision of engineers from J. W. Beretta Engineers, Inc., consultants, San Antonio, Texas. The project was completed in January, 1941, at a cost of approximately $150,000. The work was designed and constructed under the supervision of A. E. Searles, vice-president of J. W. Beretta Engineers, Inc., assisted at various times by assistant engineers A. M. Gault, J. O. Bishop, Ray E. Stubbs, T. B. Carrick, and A. M. Gibbs. The project was seriously hampered by a series of floods and by many other difficulties encountered. Great credit is due the engineering personnel for the development of construction methods and the satisfactory handling of a difficult project.

A More Dependable Pile-Driving Formula

W. H. Rabe
Chief Designing Engineer of Bridges
Ohio Department of Highways, Columbus, Ohio

***Contents in Brief**—Because of wide variations between the indicated bearing capacity for piles driven for bridges in Ohio and actual bearing capacity as shown by tests, the author undertook to develop a simple formula that would give more consistent results than those obtained with formulas now used by the Department of Highways. The results of his studies to date are given for the purpose of stimulating discussion of the new formula and possible modifications of it.*

THE DISCUSSION that follows pertains, first, to an investigation of two well-known pile-driving formulas to determine their relative dependability and second, to the development of a new formula that appears to give more nearly correct indications of bearing capacity for various types of piles in soils commonly encountered in foundation work than is now obtained by the use of the widely accepted pile-driving formulas. The effort to find or devise such a formula is believed justified by frequent rather wide discrepancies between the bearing capacity indicated by a formula and the true safe bearing as determined by test load. In fact, there is occasional proof that the bearing capacity as indicated by a formula is a dangerous misrepresentation of the capacity, although one will find more frequent evidence of extravagance.

The writer's studies were made with the assistance of field reports on test-loaded test piles belonging to the Ohio Department of Highways, of which he is an employee, but as the conclusions reached at this time are in need of further corroboration, he has not yet suggested to his employers a change of formula for pile-driving.

The Ohio Department of Highways has always used the "Engineering News" formula and it is still the official formula that is printed in the standard construction specifications. However, in 1938 the Bureau of Bridges in that department became acquainted with a formula that was published in the then proposed Boston building code. That formula is spoken of by the Ohio bridge engineers as the "Boston" formula, which is the designation used herein. As it appeared very good, it was published in a supplemental specification and has been applied on a number of non-federal projects in Ohio, on each of which test loads were specified to provide a check on the formula.

The "Engineering News" formula, in its several forms, is:

For gravity hammers: $R = \frac{2\,WH}{S + 1.0}$

For single-acting steam hammers:

$$R = \frac{2\,WH}{S + 0.1}$$

For double-acting steam hammers:

$$R = \frac{2\,F}{S + 0.1}$$

The "Boston" formula is:

For gravity hammers:

$$R = \frac{3\,WH}{S + K} \times \frac{W}{W + P}$$

For single acting:

$$R = \frac{3.6\,WH}{S + K} \times \frac{W}{W + P}$$

For double acting:

$$R = \frac{4\,F}{S + K} \times \frac{W}{W + P}$$

In which formulas: R = Indicated bearing capacity, in pounds; W = Weight of the striking parts of the hammer, in pounds; H = height of fall of the striking parts, in feet; F = Rated energy of the hammer, in foot-pounds; S = Penetration, in inches per blow (taken as the average of the last several blows); P = Weight, in pounds, of the pile (and the pile apparatus) as driven (including driving cap); $K = \frac{3\,RL}{2\,AE} + C$, in which: R = Indicated bearing capacity, in pounds (which ordinarily will be assumed here as the required capacity, in which case the complete formula is consistent at that stage in the driving when the computed R equals the required R); L = Length, in inches, of the pile (or the pile apparatus) as driven; A = Average equivalent homogeneous cross-sectional area, in square inches, of the pile (or the pile apparatus) as driven; E = modulus of elasticity of the pile material as driven, in pounds per square inch; C = a constant for a timber pile or driving cap, for which the value 0.05 is used.

There has been a great deal of argument about the relative merits of these two formulas. The "Engineering News" does not take into account the effect of the relative weight of pile and hammer, and the effect of other characteristics of the pile; the "Boston" does. The "Boston" seems to have been carefully prepared; the venerable "Engineering News" is much simpler for field application and has had tremendous use. The "answer" given by the two formulas is often quite different, showing that both cannot be right under all conditions. The "Engineering News" formula, in general, has the virtue of indicating high bearing value in good soil and the corresponding fault of giving too high a bearing value in poor soil. The "Boston" formula, on the other hand, is in general the opposite.

The writer, not posing as an expert on soil mechanics (or on pile-formula design) has participated in many such discussions and as a result decided to attempt to inform himself as to the answers given by these formulas when applied to piles that have been test-loaded. The Ohio Department of Highways has at this time reports available on 43 such piles, and these were used for the study.

Some wide discrepancies were

found between the bearing capacity as indicated by the two formulas and between the assumed safe bearing capacity (as determined from the test loading). These discrepancies not only encouraged the writer to make an attempt at devising another formula but also provided very helpful suggestions that led to the new formula described herein, on which one can apparently rely more confidently for all combinations of pile, hammer and soil.

New pile formula

The new formula, which has tentatively been named the "B" formula (and more specifically, to recognize the probable need for future revision, the "B-41" formula), is, in its several forms, as follows:

For gravity hammers:

$$R = \frac{2\,WH}{S + 0.35} \times \frac{W}{W + \frac{P}{2}} \times B$$

For single-acting:

$$R = \frac{3\,WH}{S + 0.15} \times \frac{W}{W + \frac{P}{2}} \times B$$

For double-acting:

$$R = \frac{2.5\,F}{S + 0.15} \times \frac{W}{W + \frac{P}{2}} \times B$$

In which, B = a factor dependent upon the relative pile-bearing quality of the soil, particularly at and near the bottom of the pile, and upon the type and size of the pile. Where the soil is of average bearing value and if the influence of the type and size of pile is normal, B should be considered as 1.0. In case of very firm soil and favorable influence due to type and size of pile, it may be as high as 1.5, and for the other extreme as low as 0.5. Usually, intermediate values will be used. If the soil at and near the bottom of the pile is not reliably known, B should not be taken as greater than 1.0. All other symbols are as described for the other formulas.

Comparison of results

This "B-41" formula, the "Engineering News" and the "Boston" were applied to the 43 test piles, and each was scored for each test. The score is meant to represent the degree of correctness of the indicated bearing; a score of 100 is perfect. The average of the 43 scores is:

Engineering News	57
Boston	68
B-41	84

The information on the penetrated soil was usually obtained as a sort of byproduct of the Ohio rod-driving test process for predetermination of piling lengths (discussed in *ENR*, January 2, 1941, p. 33, by J. C. Merrell of the Bureau of Bridges). Had there been full-fledged soil soundings in each case, it is believed the average score for the B-41 formula would have been still higher, because with such soundings available the B factor could have been more accurately determined.

The "score" was computed on the following basis, assuming R to be the bearing capacity as determined by the formula and Q as the true safe bearing capacity determined from the test loading:

Where R is less than Q (an undershot), $\frac{100\,R}{Q}$

Where R is more than Q (an overshot),

$$\frac{100\,(2Q - R)}{Q}$$

The "overshot" equation is based on the idea that where R is equal to $2Q$, the performance of the formula is so bad that the score deserves to be zero and where R exceeds $2Q$, the formula's misrepresentation deserves a minus score.

The true safe bearing capacity Q was determined according to the following assumptions:

Where the net settlement (amount remaining after removal of test load) in hundredths of an inch is equal to the test load T in tons, $Q = \frac{T}{2}$,

Where the net settlement is zero,

$$Q = \frac{3\,T}{4},$$

(with interpolation between these limits).

The lower limit is the same as that used by the Ohio Department of Highways and some other organizations for checking the adequacy of a pile, and the upper limit has been arbitrarily set by the writer. There is reason to believe that further study may result in the devising of a somewhat better rule but meanwhile the one used seems reasonably consistent. (A study of relative rebound is expected to shed some light on this and on other puzzling questions concerning a pile's relation to the supporting soil.)

In the studies leading up to development of the "B-41" formula the objective was to try to hit the bull's-eye without getting on the wrong side. An all-purpose formula dare not be erratic for some conditions and combinations. If it gives answers that run parallel with test-load indications, its factor of safety can readily be altered to suit the conservatism or daring of the various engineers who use it, but if a formula's shots not only do not hit the bull's-eye but scatter all over (and off) the target, it is of course not possible to correct it by such a simple means as changing the factor of safety. Besides, it is necessary for the formula to be definite and clear-cut, so that it can be used mechanically with confidence.

The 43 tests used in the study were fairly representative and provide a good cross-section of pile-driving practice:

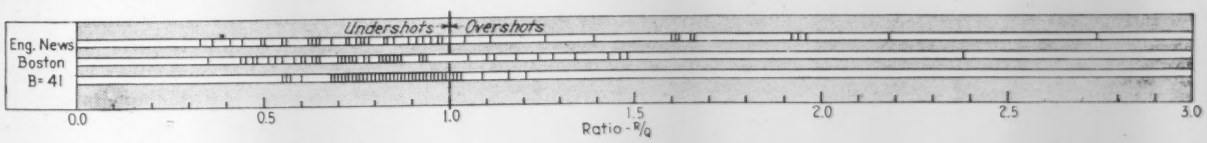
Types of piles were: timber; precast concrete; steel H-piles (with and concrete; steel H-piles (with and without concrete filler); pipe; Union Metal monotubes (of several gages, tapers and diameters); Raymond step-tapered cast-in-place; and McArthur cast-in-place.

Weight of pile (and/or pile apparatus) varied from 700 lb. to 10,600 lb.

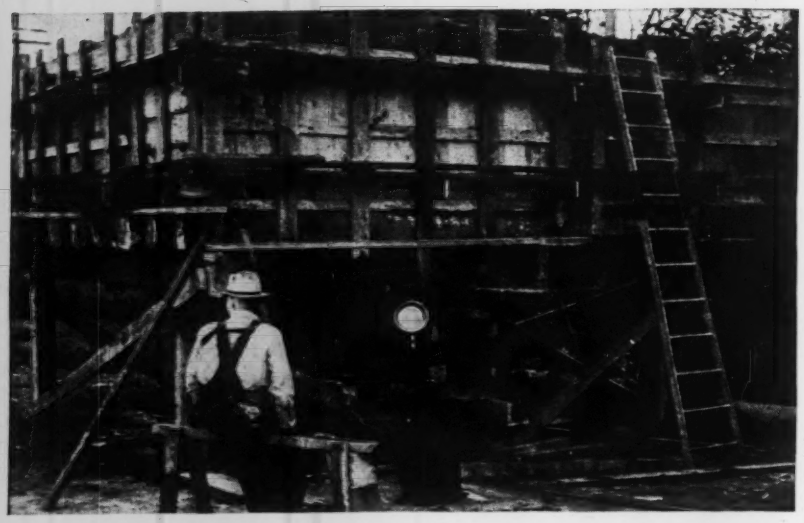
Length of pile ranged from 14 to 75 ft.

Hammers used were: gravity; Vulcan Nos. 2, 1, 0 and 5,000; and McKiernan-Terry Nos. 9-B-3 and 10 B-2. (The double-acting type was used on only four of these piles, all of which had peculiarities; so that this type of hammer was not fairly represented.)

Kind of soil at the bottom varied



Formula "B-41" made by far the best showing in a comparison of results obtained when the three formulas under study were applied to 43 piles for which actual bearing capacity was known.



Applying test loads to one of the 43 piles used in this study of pile-driving formulas. Loads were applied with a hydraulic jack.

from muck to compact sand and gravel.

Further tests proposed

The writer's conviction as to the superiority of the "B-41" formula would be more firmly established if it were based on many more than these 43 tests. Comparisons similar to those here reported will be applied to other Ohio test-loaded test-piles as the reports come in and it is hoped that other engineers will make comparisons on test-loaded piles for which they have the necessary information.

For double-acting hammers, particularly, the new formula needs further checking, and the writer will not be surprised to find in a later edition that the coefficient will be increased. The too few test-pile reports available for that type did not seem as convincing as the average.

It is not expected, of course, that on *every* test-loaded pile this formula would score the most nearly correct indication. But this study shows the "B-41" in first place on 33 of the 43 tests.

Ten other formulas, most of which have had nationwide circulation and extensive use, were also applied on a portion of these tests, to check their competitive possibilities. But, although several of them might, on the average, out-run the "Engineering News" formula, the "Boston" and "B-41" formulas would not be challenged.

Not one of the field tests used in this study was made with such a critical analysis as this in mind and the information on all of the tests is probably imperfect. Test reports that are used for such a purpose as this should be based on exceptionally good pile-driving, test-loading, soil-sampling, recording, reporting and interpreting in each case; and the practical impossibility of getting such perfect results makes a large number of tests all the more desirable. The reports on several of the piles seemed so weak in spots that the writer was tempted to discard them, but decided against that. Because of such probable individual weak spots among the tests, publication herewith of a tabulation showing data and results for each of the tests is considered not justified.

Soil bearing factor

The selection of a proper value for the factor B is, of course, very important, but it is the writer's idea that this determination be reduced as much as possible to a simple mathematical operation and in this study he used the following process:

Factor B is the product obtained by multiplying together the following influencing factors: soil factor $\times$ pile-type factor $\times$ pile-length factor $\times$ pile-cross-section factor. Sometimes (as indicated later) more than one type factor will apply.

The tentative values assigned to these influencing factors are:

Soil Factor

Compact sand and gravel	1.6
Compact sand	1.6
Gravel	1.3 to 1.5
Sand	1.3 to 1.5
Sand, gravel and clay	1.3 to 1.5
Hardpan	1.3 to 1.5
Loose sand and gravel	1.0 to 1.3
Fine sand	1.0 to 1.3
Clay and sand	1.0 to 1.3
Hard clay	1.0 to 1.3
Dense silty clay	1.0 to 1.3
Ordinary clay	0.9 to 1.1
Sandy clay	0.8 to 1.1
Sandy silt	0.8 to 1.1
Silt	0.6 to 0.8
Soft clay	0.6 to 0.8
Moist sandy clay	0.5 to 0.7
Muck	0.4 to 0.6
Moist plastic clay	0.4 to 0.6

Pile Type Factor

Unless a factor is listed (or implied) to make allowance for the influence of some peculiarity of a particular type of pile, the factor will be	1.0
In case of boulders in the penetrated soil, because of probable damage to the piles and imperfect contact, the factor will be as follows (in addition to any other type factor that may apply):	
For timber piles	0.60 to 0.75
For shell and concrete piles	0.80 to 0.90
For steel H-piles	0.90 to 1.00
In case of timber piles driven into hard soil that is not readily remoldable, because of possible damage to the piles and to allow for the probability that the imperfect shape of this type disturbs the previously-made contact with the soil	0.85 to 0.95
In case of timber piles driven into soft remoldable soil, because of the probability that the soil will mold around the deformations of the irregularly-shaped pile and increase its capacity	1.05 to 1.15
In case of steel H-piles, to allow for the possibility of imperfect contact of the soil on the full periphery of the pile for the entire length, depending upon how apt the soil is to displace and remold or repack and upon whether a plug or similar device displaces the soil as it penetrates, and upon how long and effective the plug is in its final position	0.75 to 1.00

Pile Length Factor (for length of penetration)

The value increases with the length because of the probable greater reliability of embedment of a long pile and because of the relatively greater capacity of deep soil.

For length of 10 ft.	the factor is 0.80
For length of 15 ft.	the factor is 0.85
For length of 20 ft.	the factor is 0.90
For length of 25 ft.	the factor is 0.95
For length of 30 ft.	the factor is 1.00
For length of 40 ft.	the factor is 1.05
For length of 60 ft.	the factor is 1.10
For length of 80 ft.	the factor is 1.15
For length of 100 ft.	the factor is 1.20

Pile Cross-Section Factor (for full section, usually at mid-point of the penetrated length)

The value increases with the cross-sectional displacement because of the apparent contribution made by bulk after a pile has been driven.

For 10 sq. in.	the factor is 0.90
For 20 sq. in.	the factor is 0.92
For 40 sq. in.	the factor is 0.95
For 60 sq. in.	the factor is 0.98
For 80 sq. in.	the factor is 1.00
For 100 sq. in.	the factor is 1.02
For 150 sq. in.	the factor is 1.06
For 200 sq. in.	the factor is 1.10
For 300 sq. in.	the factor is 1.15
For 400 sq. in.	the factor is 1.20

It will be noticed that the soil factor influences B appreciably more than any one of the others.

Further experimentation doubtless will cause all of these to change somewhat, and the very important soil factor particularly may experience reclassification and other revision as the writer learns more about this subject.

The reference to soil sampling should not be taken to mean that un-

usual soundings are necessary, although the better they are the better the "B-41" formula will work. These 43 tests show how well it performs with rather ordinary soil reports. As a matter of fact, although B should, of course, usually be determined by the engineer before pile-driving is begun, it will be found possible roughly to check its correctness (in most cases) from the penetration behavior of the pile.

Factor of safety

It is interesting to note that the average Q for the 43 tests is 74,800 lb., and the average R is:

Engineering News	66,400 lb.
Boston	56,500 lb.
B-41	63,000 lb.

This shows that the over-all factor of safety of the "B-41" formula is greater than that of the "Engineering News." It is less than for the "Boston" formula but this difference seems warranted in view of its demonstrated greater consistency. However, if a user would prefer still greater conservatism, this can be handily accomplished in computing the B factor by rating the soil about 10 percent lower than its type seems to warrant.

This formula is not offered as a profound scientific development. Rather, the writer worked somewhat like a cook making a new pudding (by mixing several apparently-necessary ingredients together and tasting) and the proof of this pudding (as any other) should be in the eating. After all, such a pile-driving formula (and its application) is a mixture of the dynamic and the static, which seems to make rationalizing about it rather difficult.

Future improvement of the "B-41" formula is probable, although the basic arrangement is expected to remain the same. Each value is, of course, possibly subject to some change, but the important revisions that may be incorporated in a later edition are as follows:

One form of formula may be developed to serve for all kinds of hammers with the coefficient and/or constant dependent upon the relation of the weight and fall of the hammer and its speed. For instance, although the stated formula for gravity hammers is approximately correct for the customary relation of the hammer's weight and fall, it would not be correct for a height of fall of, say, three feet. The only excuse for a lower coefficient and larger constant for gravity hammers (than for single-acting) is the greater fall and elapse of time between blows.

A change may develop in the influence of the weight of the pile. $P/3$ may be nearer right than $P/2$.

The range of the B factor may be increased to be from say 0.4 to 1.6.

The effect of taper or of its absence may require adjustment by means of another factor relating to pile-type.

The test pile information which was used in this study was compiled by the Ohio Department of Highways, of which H. G. Sours is director, and G. R. Logue, assistant director and chief engineer. Acknowledgment is also made to W. S. Hindman, chief engineer of bridges, to other colleagues in the Bureau of Bridges, and to other professional associates, for valuable criticism and comment.

Manganese Removal from Water

MANGANESE as a troublesome element in water used for commercial and domestic laundry work, causing stains in the clean clothes, is discussed in *Over the Spillway*, official bulletin of the Illinois Department of Public Health. This element is given off by plant life in reservoirs, which is the reason why surface supplies at Centralia, Murphysboro and Litchfield have experienced staining during the summer, when the organic matter has accumulated in the streams and reservoirs. Experience at these cities is typical of many others.

As little as 0.2 ppm. of manganese will cause staining of clothes. As long as the manganese remains in solution there is no staining, but if the water is aerated and the free carbon dioxide is released, the manganese will oxidize, and in this form it stains. Laundry bleach or chlorine rinses will induce oxidation and thus give rise to troubles and complaints. In places where raw water contains managnese in combination with organic matter, it is usually wise to raise the pH to about 9.0 by adding lime, so that the manganese will oxidize and can then be removed by settling and filtration. This method was followed at Centralia. There it was found that water was being drawn from the bottom intake opening at the reservoir, where the manganese was concentrated. Thus, at a depth of 22 ft. the manganese content was 8 ppm., although it was zero at the surface. A simple plan, therefore, is to raise the intake opening or take water from near the surface, which is one reason why reservoir intakes should have variable-level draw-off pipes.

Staining may be controlled without removal of the manganese. Thus, at Murphysboro the raw water from the river usually contains 4.5 ppm. of manganese but the finished water has only 2 ppm., which will not cause staining if it is maintained in solution. This is accomplished by maintaining the pH of the raw water at 7.5. The advantage is that the filter beds can be kept in better condition. However, no chlorine bleaches are used in this town, because they would oxidize the manganese and so cause staining. Actual removal of the troublesome element generally is preferred. This may be accomplished by aeration followed by adsorption in a contact bed or manganese-impregnated filter. In many Illinois plants, the filter beds act as contact beds and have a black coating, which is the oxidized manganese originally removed by filtration. It is desirable to maintain this coating and so hasten manganese removal from the water.

Manganese concentrations as low as 0.1 ppm. may produce false color reaction in the ortho-tolidine residual chlorine test. This is serious for surface water supplies where chlorination is an essential part of the treatment, because the test erroneously may indicate the presence of residual chlorine if there is manganese in the water. Since manganese may increase without notice, it is recommended that all surface supplies containing manganese be given daily bacteriological tests. The following suggestions for removal of manganese are also made: (1) aerate the water, to release free carbon dioxide and oxidize manganese before settling; (2) keep pH of water to about 9.0, so as to precipitate the manganese in settling basins; (3) at reservoir sources, take the water from higher levels of the intake towers; and (4) maintain filter beds as contact beds to remove manganese.

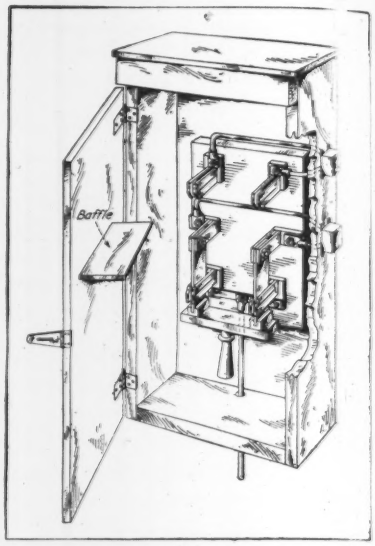
From Field and Office

Working problems and time-saving methods for engineers and contractors

A Foolproof Blasting Switch

A blasting switch that provides unusual safeguards against accidental firing is shown by the accompanying sketch. The 65-amp. switch is the double-pole, double-throw type and is mounted on a heavy slate slab. The upper clips are wired to an outside-mounted heavy-duty service outlet of the twist-lock type. The switch blades are in turn wired to a second plug mounted near the center of the box and the lower switch clips are connected by a short copper strap and a No. 6 stranded wire leads from this point to a ground such as a driven pipe or a buried pipeline.

To prevent accidental firing: (1) A baffle on the door prevents it from being closed while the switch is in the up or firing position; to close the door the switch blades must be turned down to the safe and grounded position; (2) A short section of two-wire cable with male plugs on the ends (kept only in the possession of the boss blaster) makes the connection from the power outlet to the upper switch clip outlet and prevents any unauthorized person from tampering with the lock of the switch box and throwing the switch with power on; (3) The upper switch clips have short pieces of copper strap sweated in between them to shorten the grip of the switch blades and prevent them holding in the "on" position when the pressure of the operator's hand is removed. This precaution eliminates the possibility of the blaster leaving the switch in the firing position in the event of a blast failure and then walking out to make an investigation on the charged area; (4) The grounded and short-circuited position of the switch thoroughly safeguards the blasting lead cable from ground or sneak currents; and (5) The grounded lead wire facilitates tests for ground leakage with the galvanometer in series between the network of blasting caps and the cables—P. C. ZIEMKE, *Milwaukee, Wis.*



An accident-proof blasting switch.

TRESTLE DECK IS MADE OF OLD RAILS

OVER THE AGGREGATE STOCKPILES serving the concrete mixing plant for construction of a new Navy drydock is a trestle for the use of motor trucks to bring in and dump materials. The deck is made of old rails in an inverted position with the flanges 8 in. apart assembled as shown below in panels 20 ft. long and 15 ft. wide, the latter being the roadway width. Rails of each panel are held together by 4x4-in. angles welded along the outer margin of all four sides.

A notable feature of the deck is the diagonal placement of the rails, which is expected to make the floor unusually rigid and to permit a minimum of vibration. With this diagonal arrangement, opposite ends of each truck axle will be carried by different rails, thus distributing shock and vibration.

The handrail is a ¾-in. cable supported on pipe posts welded to the angles along the panel edges. Runways for the truck tires are formed by two pairs of 3x12-in. planks bolted to the deck surface. A 10x12-in. timber bolted along the centerline of the deck serves as guide and guardrail.

The trestle was devised by the Pacific Bridge Co., which holds the contract for constructing the drydock.

Limited Deflection of Floorbeams

To prevent cracking of plaster ceilings the deflection of floorbeams in building is generally limited to 1/360 of the span. The A.I.S.C. Manual, in the tables of allowable uniform loads for beams laterally supported, gives the deflection in inches produced by the *maximum* safe loads uniformly distributed over various spans. The deflection produced by an estimated load and span that are at variance with those shown in the tables can be calculated by the formula on p. 175 of the Manual's 1940 edition as follows:

$$D = \frac{5\,W l^3}{384\,EI}$$

Where: D = deflection in inches.
W = total load uniformly distributed, including weight of beam, in pounds

l = span in inches (simple beam)
E = 29,000,000 psi.
I = moment of inertia of section, in inch^4

Substituting for the absolute deflection the deflection limited to 1/360 and solving the equation for I results in the following:

$$I = \frac{0.1616\ Wl^2}{1{,}000{,}000}$$

or, for the span L in feet;

$$I = \frac{23\text{-}28\ WL^2}{1{,}000{,}000}$$

From the values of the moment of inertia in the Manual's tables of properties for designing, a beam section can be selected having a value of I equal or slightly higher than the value found by the formula. This section will satisfy the deflection limit, aside from being stronger than necessary merely to support the load.

For a simple span with a load concentrated at the center where F = total concentrated load in pounds, l = span in inches, L = span in feet.

$$I = \frac{0.25862\ Fl^2}{1{,}000{,}000}, \text{ or } I = \frac{37.24\ FL^2}{1{,}000{,}000}$$

This method of determining beam section by way of limited deflection should not be used for beams fixed at both ends or for continuous beams where the point of maximum bending moment does not coincide with the point of maximum deflection.—PAUL HESSEMER, *Wyomissing, Pa.*

Truck Turntable Aids Jetty Job

Some 110,000 tons of rock is being placed on the outer end of the south jetty at Coos Bay, Ore., and for certain parts of the job the requirement is that the sizes must average 5 to 6 tons in each piece. The rock is delivered over the timber deck of the jetty trestle by motor trucks which dump over one side or the other. The large size of the rock and the precarious position of a truck while dumping make it desirable to use a steel turntable thereby safeguarding and expediting the dumping operation.

The turntable is designed for trucks with loads ranging up to 20 tons and its king-pin is fastened firmly to the trestle timbers. When in position for receiving a truck, the turntable is parallel to the trestle center line, aligned with inclined approaches fixed to the trestle deck. With the truck on the turntable, a "prevention chain" is attached at the front end to hold the truck down and a block prevents the wheels from moving back beyond prescribed limits. The turntable is then swung through 90 deg., the load is dumped and by continuing the turn through another 90 deg., the truck is headed back in the direction whence it came.

Dump truck at outer end of trestle after the turntable has made a 90-deg. turn.

Contractors on this job are Kern and Kibbe, Portland, Ore., and the turntable was made by the Commercial Iron Works of Portland. The work is being done for the U. S. Engineer Department.

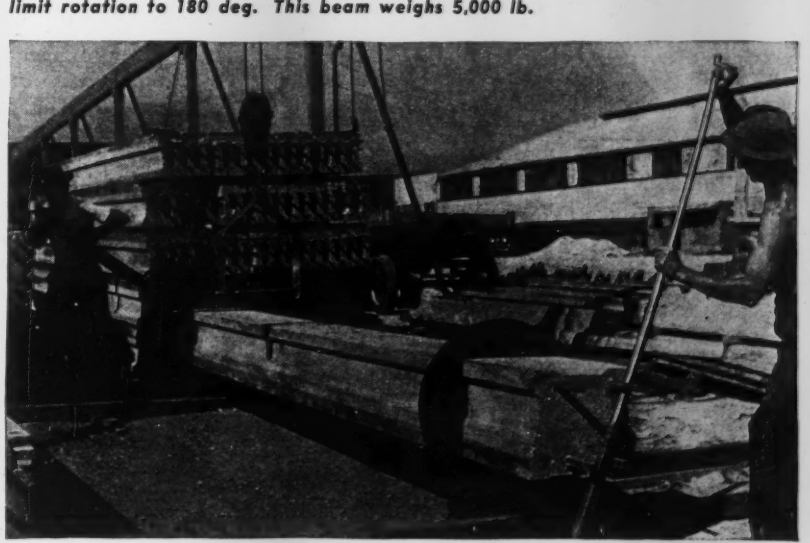
Steel Yokes on Rollers Turn Heavy Concrete Beams

Precast concrete beams for a warehouse at San Pedro, Calif., were cast upside down in order that nailing strips, which were wanted on top in the finished unit could be put in the bottom of the open-top forms.

The overhead crane that moves the unit from transfer table to stockpiles places the beam to be turned in a pair of steel U-shaped yokes each resting on two rollers mounted in a steel base. The yokes are free to rotate, on the rollers, through an arc of 180 deg. and rotation is limited to this amount by stops on the yoke ends. When resting on these yokes, the beams can be readily turned over by use of a lever on reinforcing projecting from either end. The beam is then picked up again by the crane, this time right-side up, for stockpiling or loading on the delivery trucks.

The yokes were designed and built at the casting yard by the Wailes-Bageman Co., Los Angeles, which has the contract for fabricating and erecting the precast units.

A heavy precast unit in process of being turned over by yokes on rollers. Stops limit rotation to 180 deg. This beam weighs 5,000 lb.



Notes on Sewage Disposal

A monthly summary of current developments conducted by Willem Rudolfs

INDUSTRIAL WASTES—Industrial activity speeded up by national defense creates in many places problems for sewage plant operators. Industries not only are discharging larger volumes of wastes into sanitary sewers but the character of the wastes is changed due to increased production of specific materials or the development of new processes. These problems are not peculiar to this country as indicated by a statement of C. H. Ball, president of the English Institute of Sewage Purification:

"Prior to the war the accomplishments of effective sewage purification was not always an easy task, but with the increased trade wastes—much of chemical origin—arising through war requirements, there has been brought about further difficulties in producing effluents satisfactory to all concerned." He suggests that careful consideration should be given to those firms who may have difficulties of their own and that "it will often be found that the local sewage works operator can be of invaluable assistance by giving advice coupled with tolerance."

HEAT TREATMENT OF SLUDGE—Heat treatment as an aid to sludge dewatering by the "Porteous" process (described in *ENR* Dec. 10, 1936, p. 819) has been in operation for some time at the Halifax sewage works. Here the sewage contains large amounts of greases and is pre-treated by acid-cracking, followed by sedimentation, trickling filters and activated sludge. Dewatering of the humus and surplus activated sludge was either technically impossible or not feasible economically.

Results of eight months operation on filter bed sludge, reported by Lumb (Proceedings, Inst. Sew. Purification, 1940), indicate that after cooking, the sludge could be dewatered (by pressing) to an average moisture content of 41 percent, after which it was readily air-dried and in a condition salable for a soil conditioner. Over-all heat recovery was of about 80 percent. The process is free from odor nuisances.

The byproduct liquor produced has an average B.O.D. of 4,220 ppm., which is claimed to have no noticeable effect on the purification by aeration units and very slight effect, if any, on trickling filters. This very foul liquor, equal to about twenty times that of normal sewage, requires retreatment. Since only a part of the sludge produced was heat-treated it is possible that no deleterious effects were found. The cost of treatment (without capital expenditures, replacements, interests, etc.) amounted to about 30 cents per ton wet sludge, or about $6 per ton dry matter treated. Under specific conditions this method may have considerable value, but it is doubtful whether it could compete with other methods of dewatering in general practice.

FLOW EQUALIZATION—Large variations in flow of sewage affect the operation and purification by the activated sludge process, particularly at smaller plants, with the result that purification during the night may be substantially better than that during the day, or result in an over-capacity during the night. When the sewage contains large quantities of industrial wastes the difficulties are still greater. At Wakefield, England, where the sewage flow consists approximately of 50 percent domestic sewage and 50 percent trade wastes, including wool-washing, yarn scouring and dying, breweries, malt grain steeping, iron wire cleaning and plating, casein and dairy refuse, a sedimentation tank is used for equalization of flow.

L. J. Artist (Proceedings, Inst. Sew. Purification, 1940) states that the sewage flow averages 200,000 gal. per hr. during the day and 40,000 gal. per hr. during the night. An average of 150,000 gal. per hr. is treated by the activated sludge plant, maintaining this flow by diverting the excess flow during the day, decanting at night and returning it to the inlet of the plant. During the summer months it is necessary to add sufficient chlorine to the sewage to minimize septic action in the settling tanks, using an average of 5 ppm. Suspended solids are reduced from 365 to 17 ppm. and the B.O.D. from 180 to 13 ppm. The method of operation has aided greatly in producing persistently good results without the usual difficulties encountered with sewage varying in flow, strength and character. The return effluent permits the activated sludge to be maintained in better condition and reduces septic action in the settling tanks.

SHORT-TIME DIGESTION—To deal with the maximum amount of surplus activated sludge and to reduce the volume to be handled and render it more amenable for disposal by short-time to digestion and densification is not only feasible, but has been accomplished on a large scale at Manchester, England. A report by Ardern, Jepson and Klein (Proceedings, Inst. Sewage Purification, 1940) indicates that a proportion of activated sludge added to the settled solids was between 15 and 20 percent during the summer and could be increased to 30 percent during winter months. Digesting the mixtures for a period of 12 days reduced the volume of sludge by 66 percent and the dry organic matter in the raw sludge by 34 percent. Gas production was low, amounting to 3.4 cu.ft. per pound dry organic matter in the feed sludge or about 70 percent of the anticipated quantity.

GRASS FILTERS—Use of grass filters to "polish" effluents from a settling tank or oxidation device may be of considerable value. The effect of grass filters is usually greater in summer than during the winter months, therefore they give the most efficient service at a time when "polishing" may be needed most. Hewitt (Proceedings, Inst. Sewage Purification 1940) gives some figures on grass fields in Birmingham that are used as filters. A yearly average in ppm. was as follows:

	Sus. Solids	B.O.D.
Raw sewage	180	236
Trickling filter eff.	54	19
Final tank eff.	23	14
Grass filter eff.	11	9

Grass filters to supplement sedimentation treatment appear to be of greater value when provision is made for cleaning or resting the filter.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Indeterminacy Added

THEORY OF SIMPLE STRUCTURES—Second Edition. By T. C. Shedd and Jamison Vawter. 505 pp. Published by John Wiley & Sons, New York; Chapman & Hall, London. Price, $3.75.

The change that has occurred in structural thinking during the past decade is clearly reflected in this second edition of the "Theory of Simple Structures." Thus the first edition was devoted "exclusively," as pointed out by the author, to the theory of simple structures whereas the new edition includes two new chapters introducing the subject of indeterminacy through consideration of beams and frames and then of trussed framework. The balance of the book remains substantially unchanged. The treatment of indeterminate structures is centered on discussion of the changes in shape of the loaded structure, that is, the geometric approach, rather than on the various calculating methods that have been developed.

Foundations

FOUNDATIONS OF BRIDGES AND BUILDINGS—By Henry S. Jacoby and Roland P. Davis. Third Edition. 535 pp. Published by McGraw-Hill Book Co., New York and London. Price, $5.

First published in 1914, the original text of *Foundations* by Jacoby and Davis was revised in 1925. Many things have happened in foundation practice in the decade and a half since this second printing. Processes and materials just entering the field of foundation engineering in 1925 have come into recognized use. Soil mechanics as it has now developed has had its birth and growth in but little more than 15 years. Revision of a text as old as this was needed and the authors have met the need by rewriting the text in large part, adding many new illustrations, rearranging articles and chapters and resetting the type. A new book in almost everything but name and purpose is the result.

The new volume is not a general treatise on foundations. As in preceding editions, the treatment is pointed to the use of teachers and students in engineering schools and as always it is quite strictly confined to foundations for bridges and buildings. Finally, emphasis is put on examples of structures and construction processes rather than on problems of stability and on design procedure although the treatment of these has been materially extended in this latest edition.

The book begins with two associated chapters on soil exploration and bearing capacity and on fundamentals of soil mechanics. These 76 pages of rewritten and new text give the student a general insight, which of course is all that is practicable in a limited space, into the phenomena of soil mechanics. Then follow five chapters on piles and pile driving (160 pp.), the longest discussion given to any type of foundation. New material in these chapters includes proper hammer weights, new formulas for bearing capacity and additional information on lateral strength of piles, on marine borers and the protection of timber piles from their ravages, on steel H-piles and cylinder piles and particularly on the design of sheetpiling installations. A chapter on cofferdams, three chapters on caissons (open and pneumatic), a chapter on open land excavations, one on spread foundations, three on bridge piers and one on underpinning complete the volume.

Much new material has been added in all of these chapters but it has been added in sentences, paragraphs and articles here and there and is difficult to segregate for specific notice. New subjects included, however, are deep cofferdams, cylinder foundations sunk by boring machines, grouting and cementation processes, predrainage processes, compressed air flotation caissons and the sand-island method of placing caissons. In fact but few new developments escape some measure of notice. In some cases one would wish an extension of the discussion but, as said before, the authors have had in mind a students' textbook, and exploration of new processes is perhaps better delayed until the student can undertake it with knowledge of established practices.

As in previous editions the authors have used illustrations profusely; well rendered line drawings of actual foundations almost constitute a separate presentation of foundation practices.—*Reviewed by* C. S. HILL, *Long Branch, N. J.*

Six Special Studies

FLUID MECHANICS AND STATISTICAL METHODS—Several authors. 146 pp. University of Pennsylvania Press, Philadelphia. Price, $1.75.

This book contains a collection of eight monographs presented at the bicentennial conference of the University of Pennsylvania. Four of the papers deal with problems of fluid mechanics and the other four discuss the application of statistical methods to the control of industrial processes. The authors are all recognized leaders in their particlar fields and present their topics in a most interesting and attractive manner.

In the part "Fluid Mechanics," Hugh S. Dryden shows the basic relationship of the flow of liquids and gases as characterized by the value of the Reynolds number; Theodore von Kármán discusses the dynamics of gases in "hydraulic" fashion and illustrates the theory by its application to ballistics; Anton A. Kalinske gives a most interesting study of the movement of solids in fluids, with particular application to transportation of sediment in rivers; and Thomas K. Sherwood explains the use of the principles of fluid mechanics in chemical engineering operations involving heat transfer, distillation, drying, humidifying, etc.

In the part "Statistical Methods in Engineering," Samuel S. Wilks discusses the application of the theory of probability to problems of sampling, statistical estimation and significance tests; Walter A. Shewhart explains statistical control of mass-production by means of appropriate examples; and Leslie E. Simon points out the value of statistical methods in evolving specifications for acceptance tests of ammunition and other products requiring standard quality. Finally, Roscoe Pound contributes an essay on law and legislation and suggests the possibility of statistical control of administration of justice.

It is almost miraculous that a book of only 146 pages could con-

tain the wealth of thought and information outlined above. Any one interested in philosophy, and, particularly, business executives and engineers, should find not only educational value but also real enjoyment in reading this book.—*Reviewed by* EUGENE E. HALMOS, *consulting engineer, New York.*

Boulder Project History

THE COLORADO CONQUEST — By David O. Woodbury. 367 pp. Dodd, Mead & Co., New York. Price $3.

For those who have followed the building of Boulder Dam and the All-American Canal in technical articles, without knowledge of the historic background of these engineering wonders, "The Colorado Conquest" provides a fast-moving picture of irrigation development in Imperial Valley from the earliest concept of using Colorado River water for that purpose. Geography and early exploration of the river, while sketchy in factual information, are covered with readable chapters well designed to give the general reader a necessary background. Then follow the best chapters of the book, wherein the author tells, by a unique method of utilizing a combination of historic persons and composite fictitious characters, of the early days in the settlement of the valley, following the introduction of the first irrigation water about 1900. The story of the "big break" and the two-year fight (1905–07) to get the Colorado back into its channel are especially good, and are written with effort to be impartial as to blame or credit due persons or organizations.

The period from 1909–1919 is of non-engineering interest, reviewing the steady development of the valley, setting the scene for the coming fight to secure federal aid for controlling the river and providing an All-American canal. The following decade is the record of pull-and-haul between the many conflicting interests leading up to the passage of legislation resulting in the Colorado River Compact and the Boulder Dam Act. Reader reaction will be quite divergent on these chapters, based on personal points of views relative to federal control of power, state's right and even political party affiliation, but the personages and chronology of the struggle in Congress, and out, are assembled in orderly fashion.

The building of Boulder Dam appears as distinct anti-climax for the engineer who reads the book, but probably provides all the general reader needs for this concluding phase of the struggle to curb the river. Construction operations are not only sketchy, but such expressions as "the crew in the form handled the concrete with shovels and jackhammers," (obviously meaning vibrators) and the reference to high-scalers removing rock on the canyon walls as "cherry pickers" leaves an impression that the recording of the engineering work could have been improved. After the emphasis given in earlier chapters to the need for an All-American canal, its construction, desilting facilities and use are completely ignored, which omits an important chapter of an accurate history. Further, the essential part played by Los Angeles and its metropolitan area in advocating the development of the entire river control program, as essential for its aqueduct project, does not receive its proper emphasis.

The book is at its best in its well-written picture of early settlement in the valley and the hectic days of the "big break" and will provide non-engineering readers with the background which explains the need for the Boulder Dam project.

Practical Steel Design

DESIGN OF MODERN STEEL STRUCTURE—By Linton E. Grinter. 452 pp. Published by The Macmillan Co., New York and London. Price, $5.

Written for students and beginners who have as much knowledge of structural theory as is provided in the elementary course in strength of materials, this book seeks to provide a transition into actual design practice in the field of bridges and buildings. By being more direct and explicit than is common in undergraduate texts, it should fulfill its purpose in rather high degree. Thus no time is lost in getting down to business, the chapter on riveted connections starting on p. 11. Then follow chapters on welded connections, pin and bolt connections and on timber connectors. Inclusion of timber in a book on steel construction is somewhat surprising, except that the modern timber joint does owe much of its efficiency to steel details of the shear connector type.

After joint design is mastered, the student is introduced, again in separate chapters, to tension members, compression members and beams and girders; and finally to principles and methods of design concerned with combined stresses and with stability. The final chapters bring the joint and member design practices together on such complete structural forms as factory roofs, truss bridges and tier buildings. A concluding chapter introduces the subject of design for continuity, which apparently serves the good purpose of reminding the student that he has little more than an elementary knowledge of the science of structural design. This is an unusually well written and well organized text for students of statically determinate structures.

Miscellaneous Notes on Booklets and Reprints

A LARGE AMOUNT OF INFORMATION concerning the highways of Central and South America is contained in the October, 1941, issue of "International Reference Service" (Vol. 1, No. 62), published by the U. S. Department of Commerce, Washington, D. C. Copies may be obtained from the Superintendent of Documents, Washington, D. C., or from field offices of the Department of Commerce, for five cents.

A MOST VALUABLE DOCUMENT for those concerned with the adjustment of compensation for engineering employees is "Surveys of Highway Engineering Positions and Salaries" just published by the American Society of Civil Engineers as No. 24 of its Manuals of Engineering Practice. The pamphlet describes methods used in setting up logical classifications of positions and salaries for three state highway departments. Copies may be obtained from the society, 33 West 39th St., New York. Price $1.30 to non-members.

LOADS ON VITRIFIED CLAY SEWER PIPE of all sizes and for the principal types of material used for backfill and for all depths normally used in sewer work are given in a pamphlet entitled "Trench Loading Tables" published by the Clay Sewer Pipe Association, Inc., Oliver Building,

(*Continued on p. 90*)

Positive Control for ACCURATE SPOTTING

Independent Boom Control

On this big defense job Koehring Cranes were an important factor in the high speed building construction. Koehring Cranes swing or travel while raising or lowering the boom. This important advantage saves time when handling material, setting steel or forms, spotting concrete buckets. Booms may be lowered by power for safe and positive operation. Adjustable jib boom, power controlled, and collapsible gantry frame, power controlled, are other important time-savers. When high speed, safe operation is necessary, Koehring Cranes have advantages to help speed building construction.

KOEHRING COMPANY
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KOEHRING HEAVY DUTY

HEAVY-DUTY CONSTRUCTION EQUIPMENT

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ENGINEERING Departments are working at top capacity, filling requirements of National Defense. Thousands of plans must be carefully filed, readily available, yet safeguarded. Art Metal's revolutionary PLANFILE permits true vertical filing of large sheets. Constant compression keeps drawing in best condition, yet permits easy withdrawal and insertion of single sheet without disturbing others. No stooping—no climbing! The PLANFILE saves space—actually replaces 30 old-type flat filing drawers.

". . . We have just suffered a very heavy fire loss in our office and among our equipment was this Art Metal Planfile. We are more than happy to advise you that through the protection of this file we were able to save $8,000.00 worth of valuable tracings which we had just completed. These tracings would have been a complete loss had they not been protected in this manner." — Landry & Matthes, Architects, Hattiesburg, Mississippi

Write for catalog E! Art Metal Construction Company, Jamestown, N.Y.

PLANFILES PROTECT DRAWINGS AND SPEED WORK IN ANY ENGINEERING DEPARTMENT

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STEEL OFFICE EQUIPMENT

Miscellaneous Notes on Booklets and Reprints

(*Continued from p.* 88)

Pittsburgh, Pa., for limited free distribution to interested parties. The tables are based on the Marston formula as given in Bulletin No. 96, Iowa Engineering Experiment Station, Iowa State College. Also included are tables giving the supporting strengths of extra strength and double strength vitrified clay sewer pipe, a table giving the percentage of wheel load transmitted to pipe at various depths under a roadway, and tables of pipe dimensions.

New Engineering Books

BRIDGES AND THEIR BUILDERS—By David B. Steinman and Sara Ruth Watson. 379 pp. G. P. Putnam's Sons, 2 West 45th St., New York. Price, $3.75.

THE HYDRAULICS OF STEADY FLOW IN OPEN CHANNELS—By Sherman M. Woodward and Chesley J. Posey. 151 pp. John Wiley & Sons, Inc., New York; Chapman & Hall, London. Price, $2.75.

HYDRAULICS—Fourth Edition. By Horace W. King, Chester O. Wisler and James G. Woodburn. 303 pp. John Wiley & Sons, New York; Chapman & Hall, Ltd., London. Price $2.75.

BUILDING INSULATION—By Paul Dunham Close. 328 pp. American Technical Society, Chicago, Ill. Price, $3.

BLUE-PRINT READING—By D. E. Hobart. 105 pp. Harper & Bros., New York and London. Price, $1.

OHIO HIGHWAY PLANNING SURVEY—Report of 1940. Ohio State Highway Dept., Columbus, Ohio.

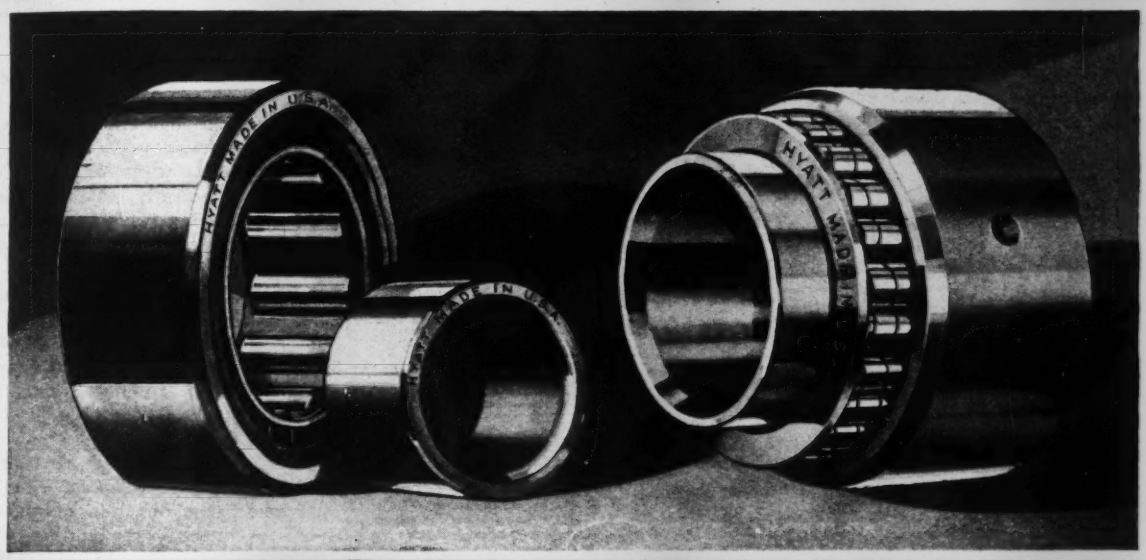
60 YEARS A BUILDER—Autobiography of Henry Ericsson written in collaboration with Lewis E. Myers. 338 pp. A. Krock & Son, 206 N. Michigan Ave., Chicago, Ill. Price, $3.50.

EYE HAZARDS IN INDUSTRY—By Louis Resnick. 321 pp. Columbia University Press, New York. Price, $3.50.

THE ECONOMIC ALMANAC FOR 1941-42—A handbook of facts about business, labor and government. 451 pp. The Conference Board, 247 Park Ave., New York. Price, $4.

NATURAL TRIGONOMETRIC FUNCTIONS—By Robert E. Benson. Third Edition. 181 pp. Mac Printing Co., Los Angeles, Calif. Price, $6.

KEEP THEM GOING WITH HYATTS



NO MATTER WHAT THE APPLICATION

Precision built... great in capacity... Hyatts are helping to lighten the loads of all mechanized defense equipment.

Meanwhile, Hyatts still are serving in their regular, and now more essential than ever, role of keeping free from bearing wear and care the machinery which produces this defense equipment.

Therefore remember, today as always, that where the loads are heavy and the going is tough you can depend on Hyatt Roller Bearings for any application.

Hyatt Bearings Division, General Motors Sales Corporation, Harrison, N. J., Chicago, Detroit, Pittsburgh, and San Francisco.

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They all point to HYDRAULIC DRIVES

Any job on which the use of high speed internal combustion engines demands the repeated starting of heavy loads . . . or an excessive amount of gear shifting to accommodate varying load conditions is a typical job for the Twin Disc Hydraulic Drive. Case studies on hundreds of working examples, in a wide variety of applications, are now available to any engineer who is planning to take advantage of the definite trend to hydraulic drives—either a Hydraulic Torque Converter or a Hydraulic Clutch. Ask for Bulletin 132 or write the Hydraulic Department for definite recommendations. TWIN DISC CLUTCH COMPANY, 1327 Racine St., Racine, Wis.

ILLUSTRATED: *Left, Hydraulic Torque Converter and right, Hydraulic Power Take-off.*

MEN AND JOBS

Paul M. Van Camp, civil engineer of Fayetteville, N. C., is handling the technical details in connection with the proposed construction of waterworks and sewerage systems at Bonnie Doone, N. C., a town that recently was incorporated after experiencing rapid growth due to the expansion of nearby Fort Bragg.

Arnold H. Vanderhoof and **Anthony Lord** have been appointed engineers for a low-rent housing project at Asheville, N. C., and **Charles G. Tennett** has been named landscape architect for the project. Mr. Vanderhoof will be in charge of the grading work, Mr. Lord will supervise construction and Mr. Tennett will direct the landscaping. They will work under the direction of **Henry I. Gaines,** architect for the housing project.

T. H. Carver, assistant city engineer of Seattle, Wash., retired Nov. 28 after 36 years' service with the city. He designed and supervised construction of Diablo Dam and had much to do with planning the city's water supply system. Besides the water-distribution system inside the city, he planned the Lake Youngs storage reservoir and a pipeline carrying water from the Cedar River watershed to Seattle.

E. A. Collier, division engineer of the Oregon state highway department at Portland, has been named chief maintenance engineer to succeed the late J. N. Bishop. He has been with the department for more than 22 years. **W. C. Williams,** division engineer at LaGrande, will replace Mr. Collier as engineer of the Portland division and **Paul Van Scoy,** assistant construction engineer at Salem, will succeed to Mr. Williams' former position.

The following changes in army officer construction personnel at the New Brighton, Minn., ordnance plant, adjacent to the Twin Cities, have been announced: **Maj. John C. Pritchard,** engineer officer in the constructing quartermaster's office, has been reassigned as assistant constructing quartermaster at a detonator plant at Jacksonville, Ark. **Capt. Charles S. Allen,** formerly engineer officer in the Seventh Zone constructing quartermaster's office in Omaha, is now on duty at the New Brighton plant to replace Maj. Pritchard. **Maj. N. W. Remley,** assistant executive officer in the accounts and audits section, has been reassigned to a project at Louisiana, Mo., where he will be assistant constructing quartermaster. He has been replaced at New Brighton

● **ST. MARY'S HOSPITAL,** Rochester, Minn.—Saved two sets of forms; heating costs cut; work not interrupted by severe winter of 1939-40; forms safely removed in 3 days instead of 28.

"Same old story," say McGough Bros., "Lehigh Early always saves us money!"

Money is not all, though, that the use of Lehigh Early Strength Cement saves these Minnesota contractors. Up there where winter doesn't fool, they've got to have safe winter concreting. And to get the speed they want, they've got to have uninterrupted building schedules. On job after job, McGough Bros. use Lehigh Early to accomplish these results. On every job of theirs to date it has come through.

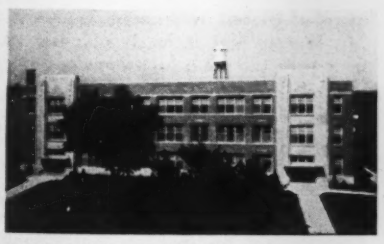
Sure it has. For Lehigh Early is the cement that in 24 to 48 hours equals the strength of normal cement at 7 days. Naturally, with this safe speed, danger of frost damage is sharply cut, as is the cost of heat protection.

But winter *or* summer, this quicker readiness of concrete permits economies no competitive-minded contractor can ignore. The Lehigh Service Department will gladly provide more proof, on request, of the time-and-money saving performances of Lehigh Early Strength Cement.

Lehigh

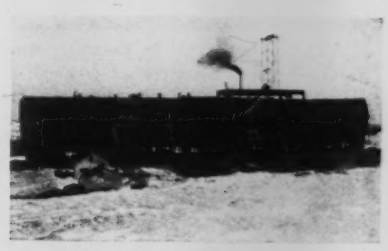
EARLY STRENGTH CEMENT

for service-strength concrete in a hurry



● **HIGH SCHOOL ADDITION,** Jackson, Mich.—4 weeks' quicker completion, forms cost cut 1/3.

● **HOLY SPIRIT SCHOOL,** St. Paul, Minn.—Form lumber cost reduced by $500, general overhead by same amount.



● **VILLA SANCTA SCHOLASTICA,** Duluth, Minn. Concreting safely done in sub-zero weather; heat protection costs cut 2/3; form sets reduced from 3 to 2.

LEHIGH PORTLAND CEMENT COMPANY • ALLENTOWN, PA. • CHICAGO, ILL. • SPOKANE, WASH.

We Make Over **200** Gasoline Engine Air and Electrically Operated Portable Power Tools and Attachments

Placing Concrete in Pavement Construction

Give any workman this powerful, yet easily portable tool and he'll place low-water-cement-ratio concrete faster, better and cheaper. He'll save you time, labor, and lumber on every form building job, above or below grade. He'll achieve a better finish on any concrete surface faster and with less effort. And, he'll handle the other 6 jobs with equal speed and economy.

The swivel-fitted, interchangeable tools for each of these tasks can be changed as easily as bits in a brace. The 3 H.P. variable speed, gasoline engine provides ample, low-cost power for each application—runs by itself and starts readily in cold weather. Contractors who have used this equipment would not be without it. Write TODAY for full details and ask for a FREE Demonstration.

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DESIGN for COMBAT

Thousands of draftsmen engaged in Defense use A. W. Faber's WINNER Techno-TONE drawing pencil—the grit-free marvel of graphite precision. Send for samples in your favorite degrees.

WINNER *Techno*-**TONE**
DRAWING PENCIL
translates **GRAY MATTER** *into* **BLACK MATTER** **MADE IN U. S. A.**

Polished rich green. Packed in metal box. **2 for 25¢**

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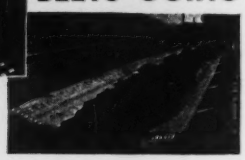
A·W·FABER-Inc NEWARK N.J.

KEEP YOUR CONVEYOR BELTS GOING

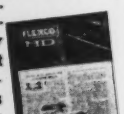


FLEXCO H D RIP PLATES are used in repairing rips and patching conveyor belts. Their use saves expensive replacements and extended shutdowns.

FLEXCO H D BELT FASTENERS make a strong, tight butt joint with long life. Recessed plates embed in belt, compress belt ends and prevent ply separation. Six sizes in steel and alloys.

● **Avoid shutdowns and lengthen the life of your conveyor belts and bucket elevator belts by using Flexco belt fasteners. Thousands of companies have stepped up the performance of conveyor lines and cut costs by using Flexco methods.**

Bulletin F-100 shows exactly how to make tight butt joints in conveyor belts with Flexco. Also illustrates step by step the latest practice in repairing rips and putting in patches.



FLEXIBLE STEEL LACING CO.
4656 Lexington St., Chicago

Write for your copy.

FLEXCO HD BELT FASTENERS

Sold by supply houses everywhere

by **Lieut. John H. Joy,** of the local plant office, who was assistant executive officer in the administrative section. **Lieut. John S. Middleton** has replaced Lieut. Joy.

Bruce Mengel, draftsman with the U. S. Indian Service at Rosebud, S. D., has resigned to accept a position with the Boeing Aircraft Co. of Seattle, Wash., in their engineering department.

J. L. Early, who served as WPA project superintendent on the construction of an addition to the McDowell County courthouse at Marion, N. C., which has just been completed, is now WPA supervisor of the widening of bridges and culverts on U. S. Highway 70 between Marion and Old Fort.

W. L. Trevathan on Dec. 1 was reappointed county surveyor at Wilson, N. C. The appointment was made by the Wilson County Commissioners.

Ralph Arnold, of Sioux City, has been appointed to the office of architect for the Iowa State Board of Control. He succeeds Henry J. Liebbe, deceased.

Herbert Fritz, maintenance engineer for the public schools at Burlington, Iowa, has resigned to accept a position as associate engineer to the constructing quartermaster of the Seventh Zone, with headquarters at Omaha, Neb.

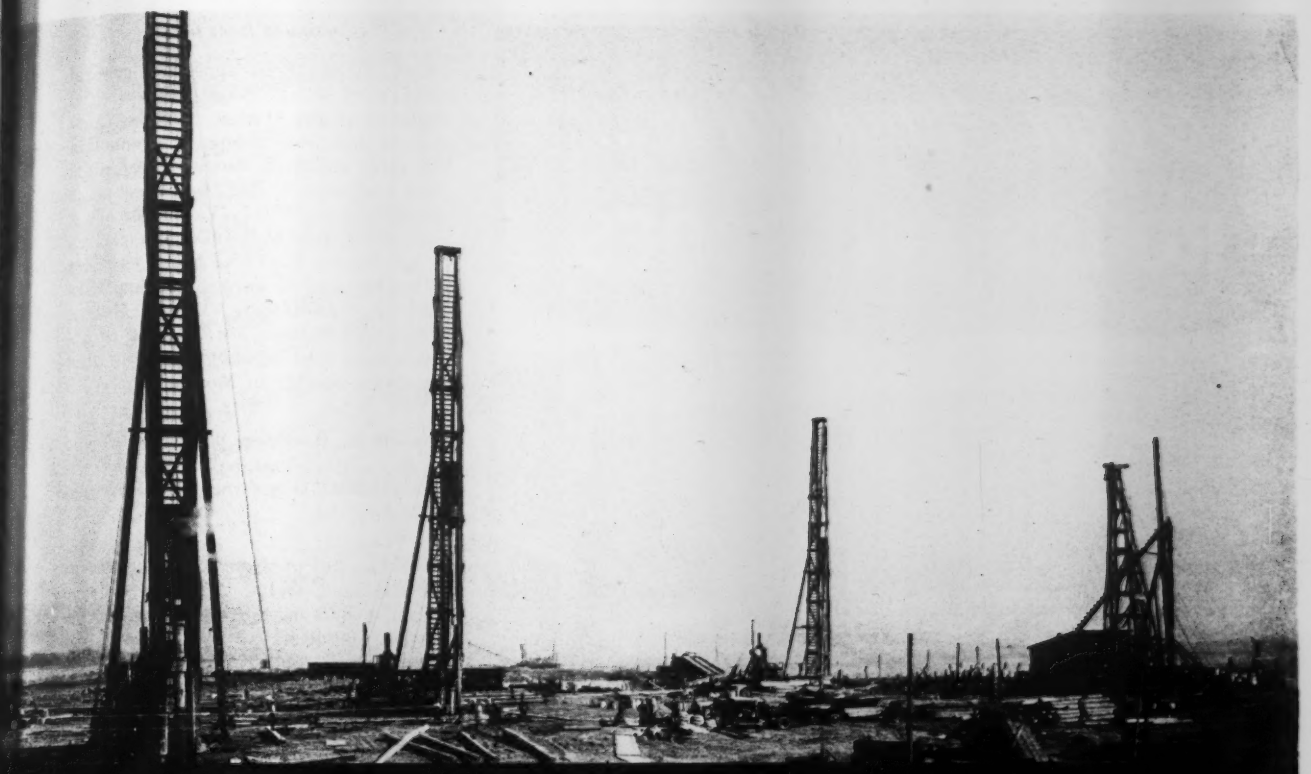
Clarence E. Bryant, Powers Lake, N. D., assistant chief engineer for the North Dakota Public Service Commission, has been named chief engineer to succeed **M. T. Ulteig,** who resigned to accept a position with the Rural Electrification Administration in Washington.

W. M. Piatt, Durham, N. C., consulting engineer, has been retained by the town of Asheboro, N. C., to make a survey in preparation for the extension of the town's water system, and the construction of a new dam and reservoir.

Philip C. Harper, of David City, Neb., has been named state airport engineer by the State Aeronautic Commission. Mr. Harper was formerly a junior engineer with the state highway department.

Lt. Col. A. H. Cowie, manager of the eastern division of the Dominion Bridge Co., Ltd., has been appointed a director and a vice president of Wartime Shipping Limited, government-owned corporation set up to carry out Canada's national shipbuilding program for war purposes. **R. E. Heartz,** assistant chief engineer of Shawinigan Water and Power

(*Continued on p. 98*)



PILES

FORD ASSEMBLY PLANT,

Edgewater, N. J.

5,079
COMPOSITE PILES.
Wood length up to 110 feet.
Concrete sections of 30 feet.

WESTERN'S "FOLLOW THROUGH METHOD" is used for Composite Piles over 90 feet long. Apparatus is driven into ground, core removed, wooden section driven through casing. A dry joint is assured by rope grommet on wood, which acts as piston to force water out of casing. Concrete section is then placed with all advantages described for "Follow Down Method" on opposite page.

WESTERN FOUNDATION COMPANY
WESTERN CONCRETE PILE CORP.

52 Vanderbilt Avenue
New York

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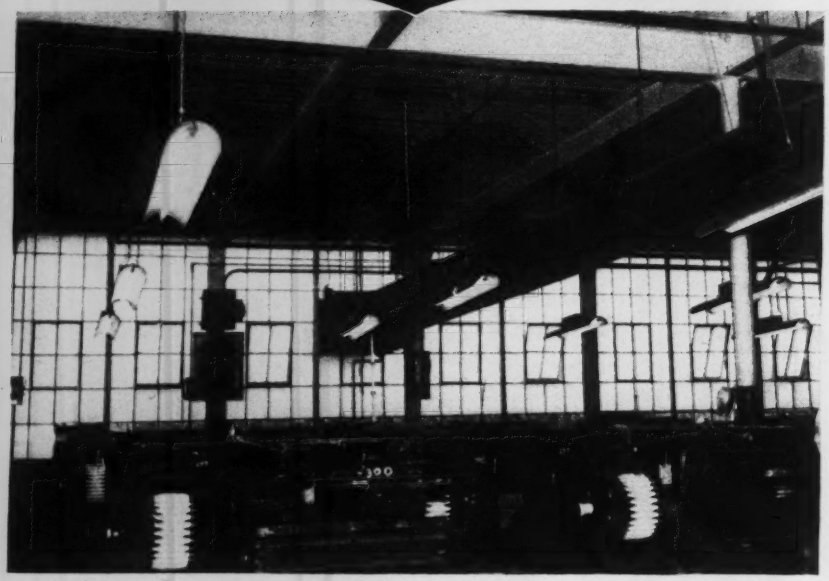
High Humidity is... ROUGH ON ROOFS



But "CZC" SOLVED THE PROBLEM *in this weave room*

HIGH humidity is a "must" in the weave room. But while it is necessary for spinning, it wrecks roofs. And with equipment attached to the roof, the installation of new timbers becomes a doubly expensive job.

At this Southern textile company, the answer is simple — treatment of all roof timbers with Du Pont CZC. This treatment provides protection against decay and termite damage. And it gives the added advantage of lumber that's fire retardant, clean, odorless, and paintable.

Du Pont CZC provides an added factor of safety wherever it is used — by extending the full strength of lumber over a much longer life. Write for location of treating plants. E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Department, Wilmington, Delaware.

SPECIFY LUMBER TREATED WITH DU PONT CZC
CHROMATED ZINC CHLORIDE

(*Continued from p. 94*)

Co., Ltd., has been appointed general manager of W.S.L.; **G. O. Vogan,** chief engineer of the Quebec Streams Commission, has been appointed production manager; and **G. S. Burrows,** of United Steel Corporation, Ltd., has been made manager of the W.S.L. Vancouver office, succeeding **J. O'Halloran,** who returns to his regular duties as plant engineer of Anglo Canadian Pulp and Paper Mills, Ltd., at Quebec City. Messrs. Heartz, Vogan and Burrows are on leave of absence from their regular duties, the first two being located in Montreal.

Edward P. Hackman is now employed in the engineering department on the new $35,000,000 government building at Arlington, Va.

Jerry A. Nolen, former city engineer for Seminole, Okla., has been ordered to active duty in the war plans section at the Aberdeen Proving Ground, Md. **Artie Marvel** replaces him at Seminole.

E. R. Brissette, of Jacksonville, Fla., formerly with the Duval Engineering & Construction Co. in building the naval air station in Jacksonville, has left for Trinidad, B.W.I., where he will be superintendent of transportation for the Walsh Construction Co. and the George F. Driscoll Co., contractors for the U.S. Army airbase being built there. A resident of Jacksonville for 21 years, Mr. Brissette formerly served as manager of the Mack Truck Co. Since 1936 until he was employed on the air station job in Jacksonville, he experimented with internal combustion engines on fuel saving devices.

The following four men have accepted positions with the Boeing Aircraft Co. of Seattle, Wash., and reported to work on or about Dec. 1: **Keith Bahrenburg** formerly with A. H. Read, contractor, and with the Wyoming state highway department for 15 years, is in the administrative engineering department; **R. C. Pike,** resident engineer on bridge construction with the highway department for the past 14 years, will have the rating of engineer; **Erling Erickson** and **Charles L. Rigdon,** also formerly with the highway department, will have the rating of engineer's apprentice.

Phil Mitchell, civil engineering graduate of the Duke University School of Engineering, Durham, N. C., with the class of 1940, is field engineer with the Walsh Construction Co. of Davenport, Iowa, and now is working on a base for the U. S. government at Trinidad, B.W.I. His home was formerly at Rock Island, Ill.

when you require
WATER TIGHTNESS
STRENGTH
HIGH CARRYING CAPACITY
LONG LIFE ✓
LOW MAINTENANCE
OVERALL ECONOMY
in a pipe line
remember LOCK JOINT

"...expected life 100 YEARS"

A prospective pipe line purchaser wanted up-to-the-minute information on Lock Joint Reinforced Concrete Pressure Pipe.

He telegraphed a score of water works engineers who were using one or more Lock Joint Reinforced Concrete Pressure Pipe Lines, questioning capacity, watertightness, maintenance, and expected life.

All of these men replied—and the answers to the question of expected life ranged from "estimated life one hundred years" to a not so specific but sincere "life better gauged by grandchildren"!

There is a definite, logical reason for the expected long life of this pipe. This reason is that the rich, dense concrete protects the steel reinforcement from corrosion, and also prevents tuberculation and electrolysis.

When you are planning a pipe line, you can build long life into that line by constructing it with Lock Joint Reinforced Concrete Pressure Pipe.

LOCK JOINT PIPE COMPANY
AMPERE, NEW JERSEY

BRANCH OFFICES
Chicago, Ill. Kenilworth, N. J. Kansas City, Mo.
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Rock Island, Ill. Hartford, Conn.
Cleveland, Ohio Navarre, Ohio

PRESSURE SEWER
SUBAQUEOUS CULVERT

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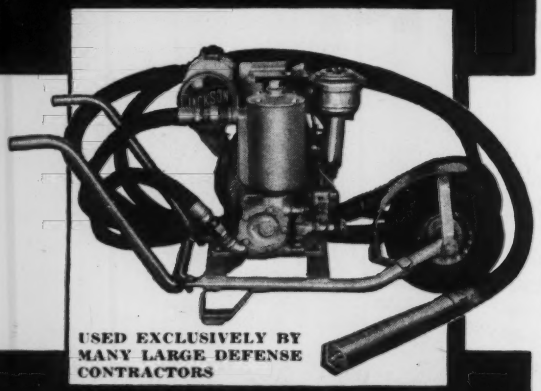
. . . If you want to make speed profitably . . . GET DEPENDABLE EQUIPMENT . . Buy the Fast . . .

JACKSON Hydraulic Concrete Vibrator

DESIGNED TO "TAKE IT" 3 SHIFTS A DAY—EVERY DAY

- Automatic pressure lubrication—requires no attention.
- 34-ft. hose—2¾" vibrator head.
- Adjustable frequency to 6800 R.P.M.—submerged in concrete.
- Powerful gas engine—4.7 H.P.
- Long-lived, ball-bearing, rotary, hydraulic pump.



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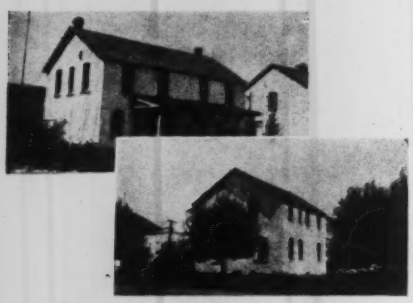
ELECTRIC TAMPER & EQUIPMENT CO.

LUDINGTON, MICHIGAN

AT A CANADIAN GOLD MINE



These photos show three of nine old brick buildings reconditioned by the use of "GUNITE," on the property of Dome Mines, Ltd., South Porcupine, Ontario, Canada. The buildings include a machine shop, power house, refinery, store and dwellings.

Our Bulletin 1200 shows many examples of the superiority of "GUNITE" for building, both in reconditioning and new construction. Send for your copy today!

The "CEMENT GUN" can be bought by anyone, and used without restrictions.

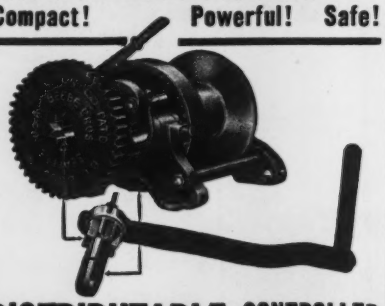
CEMENT GUN COMPANY

Manufacturers of the "CEMENT GUN"

ALLENTOWN, PENNSYLVANIA

WE ARE ALSO "GUNITE" CONTRACTORS LET US BID ON YOUR WORK

Compact! Powerful! Safe!



DISTRIBUTABLE CONTROLLED POWER

with Beebe Bros. ALL STEEL HAND HOIST

SEATTLE, U.S.A.

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Money Has Been Saved on These Jobs!

1200' assembled pipe (132 Tons) were lowered to bed of Mississippi at St. Paul with 9—5-Ton Beebes, three lines to each hoist through blocks.

Hudson River Bridge sidewalks were laid in sections with 32—5-Ton Beebes.

Longest wooden trusses in world were installed with ONE 5-Ton Beebe after power hoists proved impractical.

★

When raising, lowering, or placing costs by power are a serious problem, the answer is the right number of Beebe Bros. All Steel Hand Hoists MANNED IN UNISON. Available in 2, 5 and 15 Ton sizes. Sold through leading dealers in all trade centers. List of dealers sent upon request.

BEEBE BROS., 2720 6th Ave. S., Seattle, U.S.A.

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"THE STRONGEST GEARED POWER FOR ITS WEIGHT IN THE WORLD"

MEETINGS

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, New York, N. Y., Jan. 21–23, 1942.

NATIONAL SAND & GRAVEL ASSN., 26th annual convention, Netherland Plaza Hotel, Cincinnati, Ohio, Jan. 28–30, 1942.

NATIONAL CRUSHED STONE ASSOCIATION, 25th annual convention, Netherland Plaza Hotel, Cincinnati, Ohio, Feb. 2–4.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, 23rd annual convention, Olympic Hotel, Seattle, Wash., Feb. 16–19.

AMERICAN CONCRETE INSTITUTE, 38th annual convention, Palmer House, Chicago, Ill., Feb. 17–19.

REGIONAL AND LOCAL MEETINGS

ILLINOIS ROAD BUILDERS ASSOCIATION, 5th annual meeting, Drake Hotel, Chicago, Ill., Jan. 6.

ILLINOIS CONTRACTORS ASSOCIATION, annual meeting, Hotel Abraham Lincoln, Springfield, Ill., Jan. 7–8, 1942.

WISCONSIN ROAD SCHOOL, sponsored by Wisconsin Highway Commissioners Association and Wisconsin County Highway Committee Members Association, Milwaukee, Wis., Jan. 7–9, 1942.

KANSAS CONTRACTORS ASSOCIATION, 1942 convention, Kansas City, Mo., Jan. 8–9.

HIGHWAY ENGINEERING CONFERENCE, University of Colorado, Boulder, Colo., Jan. 8–9.

LOUISIANA ENGINEERING SOCIETY, annual meeting, St. Charles Hotel, New Orleans, La., Jan. 9–10.

OKLAHOMA SOCIETY OF PROFESSIONAL ENGINEERS, annual meeting, Tulsa, Okla., Jan. 23–24.

WYOMING ENGINEERING SOCIETY, 23rd annual convention, Cheyenne, Wyo., Jan. 23–24.

KENTUCKY SOCIETY OF PROFESSIONAL ENGINEERS, annual meeting, Lafayette Hotel, Lexington, Ky., Jan. 23–24.

TEXAS SOCIETY OF PROFESSIONAL ENGINEERS, annual meeting, Beaumont, Tex., Jan. 24.

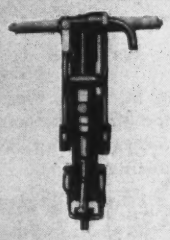
ILLINOIS SOCIETY OF ENGINEERS, annual meeting, East St. Louis, Ill., Jan. 29 31.

ANNUAL HIGHWAY ENGINEERING CONFERENCE, University of Utah, Salt Lake City, Utah, Feb. 2–6.

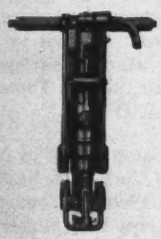
(*Continued on p.* 102)

"Yes, Sir.. IT'S WATER-COOLED THAT'S THE ONLY KIND I BUY!"

"Why do I insist on having Gardner-Denver water-cooled portable compressors? Because water-cooling means lubricating oil economy. Because I want my air supply to be unaffected by hot or cold weather—by altitude—or by tough working conditions. Because I want cooler air. Because I want portables I can depend on *all* the time!"



Gardner-Denver S55 Sinking Drill



Gardner-Denver S73 Sinking Drill

Powerful . . . fast . . . reliable . . . Gardner-Denver Sinkers are available in a complete line.

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● Thousands of hours of dependable operation—freedom from delays—remarkably low maintenance costs! These are some of the additional reasons why experienced users prefer Gardner-Denver *water-cooled* portable air compressors which assure constant load operation—full air output, regardless of weather or altitude. Write today for full information on the complete line of Gardner-Denver water-cooled portable air compressors. Address Gardner-Denver Company, Quincy, Illinois.

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CONSTRUCTORS ASSOCIATION OF WESTERN PENNSYLVANIA, annual meeting and dinner, William Penn Hotel, Pittsburgh, Pa., Feb. 4.

MINNESOTA FEDERATION OF ARCHITECTURAL AND ENGINEERING SOCIETIES, annual meeting, Nicollet Hotel, Minneapolis, Minn., Feb. 11–14.

OHIO SOCIETY OF PROFESSIONAL ENGINEERS, annual meeting, Deshler-Wallick Hotel, Columbus, Ohio, Feb. 12–13.

SOUTHEASTERN STATE HIGHWAY OFFICIALS, first annual meeting, Grove Park Inn Hotel, Asheville, N. C., Feb. 12–13.

SOUTHWEST ROAD SHOW AND SCHOOL, The Coliseum, Wichita, Kansas, Feb. 24–27.

ASSOCIATION OF HIGHWAY OFFICIALS of the North Atlantic States, Hotel Benjamin Franklin, Philadelphia, Pa., Feb. 25–27.

ELECTIONS AND ACTIVITIES

A. H. BAUM, JR., of St. Louis, Mo., is the new president of the Missouri Society of Professional Engineers, having been elected at a recent meeting.

THE ENGINEERS CLUB, Winston-Salem, N. C., has elected R. P. Reece as president. Mr. Reece had served as vice president of the club during the past year. Arvin Page was elected vice president and C. E. Stephenson was re-elected secretary and treasurer. Named to the board of directors were: Charles F. Vance, C. M. Sprinkle, R. A. Thomas, J. D. Spinks and L. A. O'Brien.

THE COLLEGE OF ENGINEERING of New York University, New York City, has announced a course of lectures on steel construction to be given this winter in cooperation with the American Institute of Steel Construction. Attendance at these lectures will be open, without charge, to students and others who are interested in the subject matter, as well as employees of structural steel fabricators and contractors. For additional information address the American Institute of Steel Construction, 101 Park Ave., New York, N. Y.

H. G. BAITY, Chapel Hill, N. C., has been named to represent the North Carolina section of the American Water Works Association on the board of control of the national association. W. M. Franklin of Charlotte is chairman of the nominating committee which will select the nominees from which the 1942 officers will be elected by mail ballot; and J. H. Henderson of Fort Bragg and E. D. Burchard of Asheville have been named trustees of the North Carolina section.

E. J. PEARSON, of Minot, N. D., has

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been elected president of the North Dakota Water and Sewage Works Conference, which recently held its annual conference at Jamestown. Other new officers are: Stephen Monek, Jamestown city engineer, vice president; and H. G. Hanson, Bismarck, secretary-treasurer.

WHEN THE NEW YORK State Highway Chapter of the AGC met at Syracuse, N. Y., Dec. 3 for a two day meeting, which was attended by about 400, priorities, post war planning, and the defense construction program were discussed. William Robinson, district engineer for the New York State Department of Public Works, pointed out how highway construction can be expected to form a large share of the post war work. He stated, "Assuming that the government exercises its rights to recapture the rental equipment now in use on federal projects and elects to throw such equipment into road construction on a relief basis, calling it another emergency to provide immediate employment, what is going to be the position of general contractors? It will be a very serious matter for all such builders and they had better be acting without loss of any time."

To Mr. Robinson the plans of developing the Public Works Reserve were ambiguous. In speaking of road building as part of the program, he said, "If it means that federal financial participation in post war construction of highways is to be handled through the normal, adequate organization of the Public Roads Administration, and through them the trained personnels of the state highway departments, then all is well. If instead WPA and relief are injected, it will be an entirely different matter and one in which contractors will be vitally interested."

Heber Ashley, president of the New York State Association of Highway Engineers, discussed President Roosevelt's reluctance to build highways other than those of immediate importance to national defense. Mr. Ashley stated, "It has been rumored that the President might exercise priorities control to block non-defense jobs. This would seem to have serious implications for future highway programs. Having this thought before us, it is the job of all groups interested in an adequate highway construction program to start working hard to secure a proper priority rating to prevent stagnation of the large highway industry, which has contributed such a large share to the American way of life."

Harvey O. Schermerhorn, New York State Highway Commissioner, among other things discussed how labor and priorities may affect highway construction in his state. He said, "No matter what our construction program may develop to be next year, my department will continue its preparation of improvement work, getting ourselves in shape so that

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In the serious real-life business of keeping construction under way, Yellow Strand Preformed Wire Rope is one of the mainstays. Its rugged *endurance* especially fits it for heavy duty on shovels, draglines, scrapers and other machines. Through skillful balancing of elasticity, toughness, strength, it keeps them in *productive* service by reducing shutdowns.

With Yellow Strand on the job, you can speed up faster under full load, handle more pay-tons or pay-yards, because every reel is practically pre-broken-in. The preforming makes a limber, smooth-running line that's easy to socket and splice; one that protects hands and sheaves from wickering, that resists kinking, drum crushing and bending fatigue.

Put these premium qualities to work for you by installing Preformed Yellow Strand the next time you need wire rope. Its long life, its low *final* cost, will loom up when you figure the profits.

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THESE items are presented in a new booklet published by the West Coast Lumbermen's Association. A copy will be mailed free upon request. Write for this booklet today. Today's heavy travel demands good highways. Wood is available—bridges and other highway structures, strong and durable for anticipated years of service, may be built NOW—with speed and economy.

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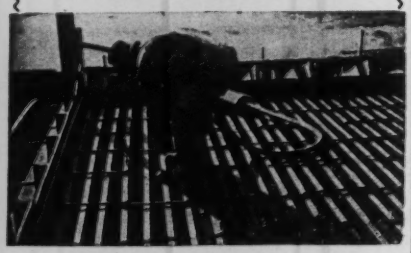

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when the emergency is over we will be able to let a large volume of work without delay. The most pungent obstacle is getting rights-of-way. That is beyond our control, unless relief is brought about by legislature. Our hands are tied and we can do nothing until there is some relief in this situation."

M. W. Watson, president of the AGC, also spoke at the second afternoon meeting. Mr. Watson told of the large amount of road work which could be done if it were possible to carry out the program. He stated, "during the last session of Congress, it was pointed out that there should be immediate rebuilding of 58,857 miles of state highways at an approximate expenditure of $1,737,000,000, widening of 26,326 miles at an approximate expenditure of $737,520,000, and then relocation of 21,377 miles of highway at an approximate expenditure of $1,026,000,000. There were also about 21,600 bridges to be widened or rebuilt at an approximate expenditure of $444,476,000. The grand total is $3,945,105,000 of work the state highway departments could have carried out at that time. There has not been a considerable change in those figures up to date."

Other speakers included Maj. K. D. Nichols, in charge of the War Department's Rome, N. Y., bomber repair depot, who told of that work; Lt. Col. A. B. Jones, district engineer for the St. Lawrence River district, U. S. Engineers, who described the St. Lawrence River project; H. K. Bishop, of the Public Roads Administration, who described recent highway legislation, and H. E. Foreman, managing director of the AGC, who also discussed highway legislation.

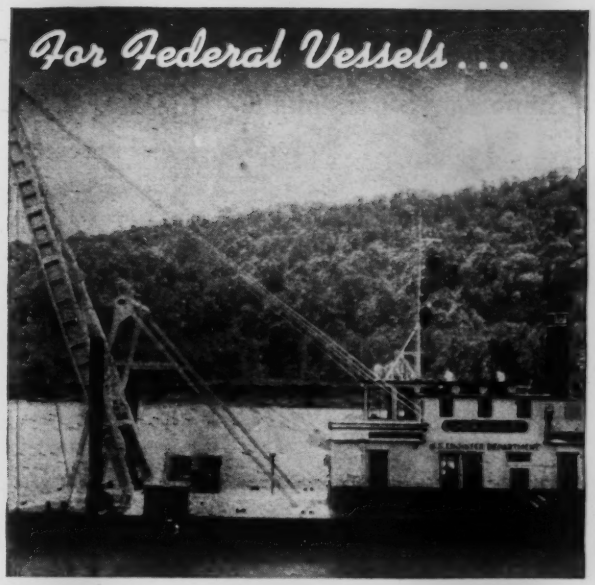
See last week's issue of *ENR* for a list of the chapter's officers for the coming year.

M. C. Miller, engineer of the Hawkeye Portland Cement Co., Des Moines, Iowa, was elected president of the Iowa section of the American Society of Civil Engineers at the recent annual meeting held in Des Moines. Mr. Miller succeeds Mark Morris, safety and planning engineer of the Iowa state highway commission.

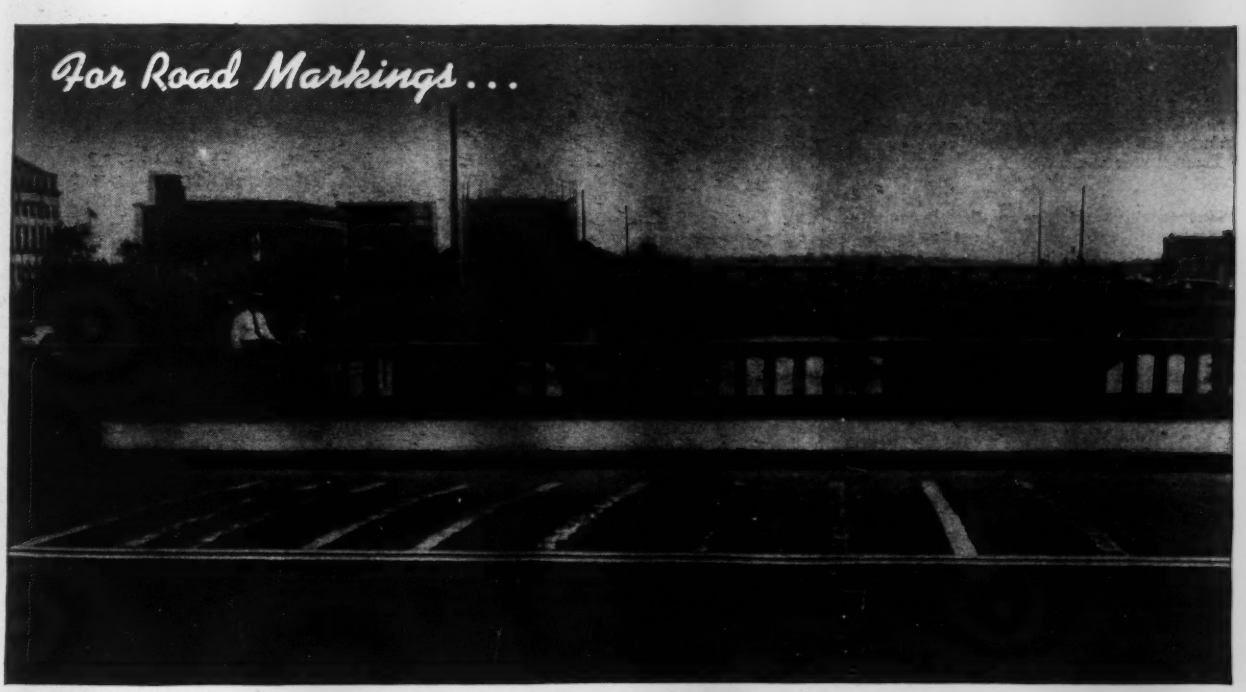
Other officers elected were: E. W. Lane, Iowa City, vice president; J. S. Dodds, of the Iowa State College civil engineering department; and John Tippee, Des Moines city engineer, as directors. L. O. Stewart, head of the civil engineering department at Iowa State College, was re-elected secretary-treasurer.

The Iowa Engineering Society, holding its meeting jointly with Am. Soc. E. E. nominated the following officers for 1942: Maurice Miller, Des Moines, Iowa, and C. M. Stanley, Muscatine, president, and E. W. Blom, Ames, and John M. Drabelle, Cedar Rapids, vice president. Election will be by mail ballot.

Although constantly exposed to all kinds of weather, fire call boxes must remain bright in appearance to assure immediate identification in emergencies. The City of St. Louis, Missouri, has made this possible, without frequent repainting, by specifying red, yellow, and black enamels containing BAKELITE Resin vehicles.

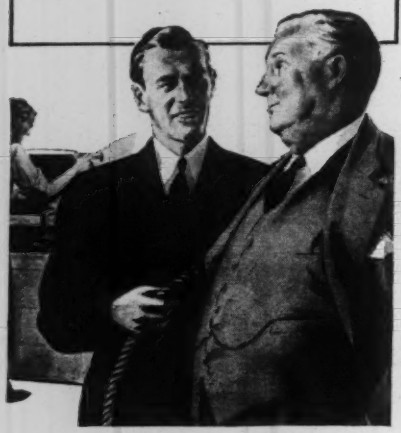


Longer periods of maintenance-free service are assured for the United States Engineers' new derrick boat HERCULES, with primers, surfacers, and finishing coats based on BAKELITE Resins. Formulated to rigid specifications, these anti-corrosive finishes also are employed on locks, dams, and other federal structures on inland waterways.



In recent tests conducted by the City of Des Moines, Iowa, ten competitive traffic paints were applied in stripes, on one of the city's busiest roadways. After a half-hour's drying time, traffic was allowed to pass over the stripes. Within ten days, several of the paints had failed completely. However, the BAKELITE Resin vehicle proved so superior that city officials adopted it in their specifications. Even at the end of six months, the paint based on BAKELITE Resin was still in good condition while *all* other test samples had failed.

"Who said rope is not important in this plant?"



PURCHASING AGENT: I'm not saying that rope isn't important, Steve. I'm just saying that you're too steamed up about it. A good piece of rope is a good piece of rope.

ENGINEER: You're way off base. There is a big difference in rope. You come down to the laboratory and I'll show you . . .

PURCHASING AGENT: Yeah, I know. You'll show me a sheet of figures a mile long, full of square roots and decimal points . . .

ENGINEER: I'll show you one table that will hit home. It's on tensile strength. The Plymouth strength figures are guaranteed *minimum*, rather than average. That gives you an added safety factor.

PURCHASING AGENT: Now you're talking my language.

ENGINEER: You come down and see the rest of the facts I have on Plymouth Rope and you'll be buying "The Rope You Can Trust," starting now!

Government priorities require the manufacture and sale of an "emergency grade" of rope for certain specified uses. This "50/50 Brand," as made by Plymouth, contains the maximum amount of Manila fiber allowable under the law.

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In these troubled times, business-as-usual is obviously impossible. However, it is possible for us to render service-as-usual! Frequently, we issue bulletins on OPM regulations as they apply to rope. Free copies of these bulletins may be obtained by writing to "Emergency Service Department, Plymouth Cordage Co., North Plymouth, Massachusetts."

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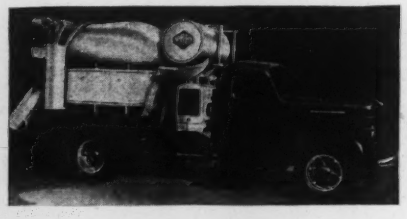
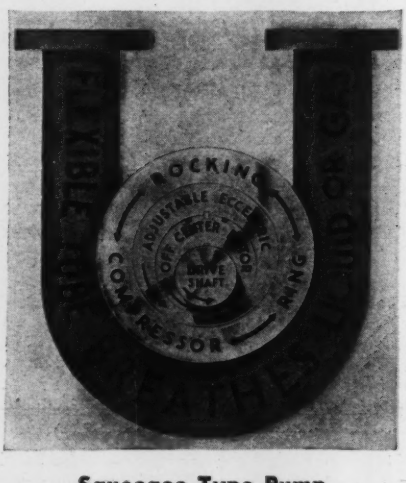
New Aids to the Constructor

Equipment and material announcements and manufacturers' news



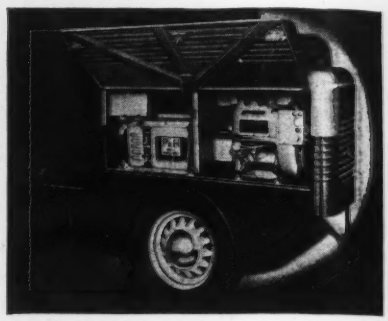
3½ Yd. Truck Mixer

A new No. 3½ Smith-Mobile with ratings of 3½ yd. for truck mixing and 4.58 yd. for agitating, has recently been announced. This new machine replaces the former No. 3 Smith-Mobile, the industry's first high-discharge truck mixer introduced four years ago. It is claimed this new Smith-Mobile is much faster in charging, mixing and discharging, especially for the drier and stiffer mixes. Features of the new model include: all-geared, fully inclosed transmission; totally inclosed, oil-tight pump drive; big 36 in. drum opening with self-centering feed chute; self-cleaning closing door with worm and worm gear operating unit; and a powerful 42½ hp. engine.—*The T. L. Smith Co., Milwaukee, Wis.*



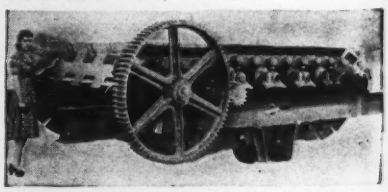
Squeegee Type Pump

A new type pump, operating on a "squeegee principle," consists of a flexible rubber tube which is alternately squeezed and released in rocking, squeegee manner so that liquid or gas is actually breathed into and out of the tube. The liquid or gas being pumped is totally inclosed within the tube from the time it enters the pump until it leaves, thus it cannot come in contact with any metal part of the pump. The rocking compressor ring does not rotate so there is little wear on the tube. The drive shaft forces the adjustable eccentric and off-center rotor around in such a manner that the pumped material is forced ahead. It is available in single and double stage units in capacities ranging from ½ gpm to 100 gpm with suction lifts up to 25 ft. and discharge pressures of 50 lb.—*Downingtown Mfg. Co., Huber Pump Division, Downingtown, Pa.*



Welders

Two new P&H Hansen gas-driven engine welder units, Model WN-150 and WN-200, with capacities of 15 to 200 amps. and 30 to 260 amps. respectively, have just been introduced. Equipped with the latest type generators, they are powered by a direct-connected heavy-duty, 4-cycle, 4-cylinder, V-type Wisconsin gasoline engine. These units are mounted on pneumatic tired trailers with low centers of gravity which permit towing at normal traffic speeds. The wide welding ranges, single current positive power controls and mobility of these units suit them ideally for portable use. The welders are sturdily and compactly built for lasting service and have compartments inside the housing for storage of cables, operator's tools, welding rod, etc.—*The Harnischfeger Corporation, Milwaukee, Wis.*

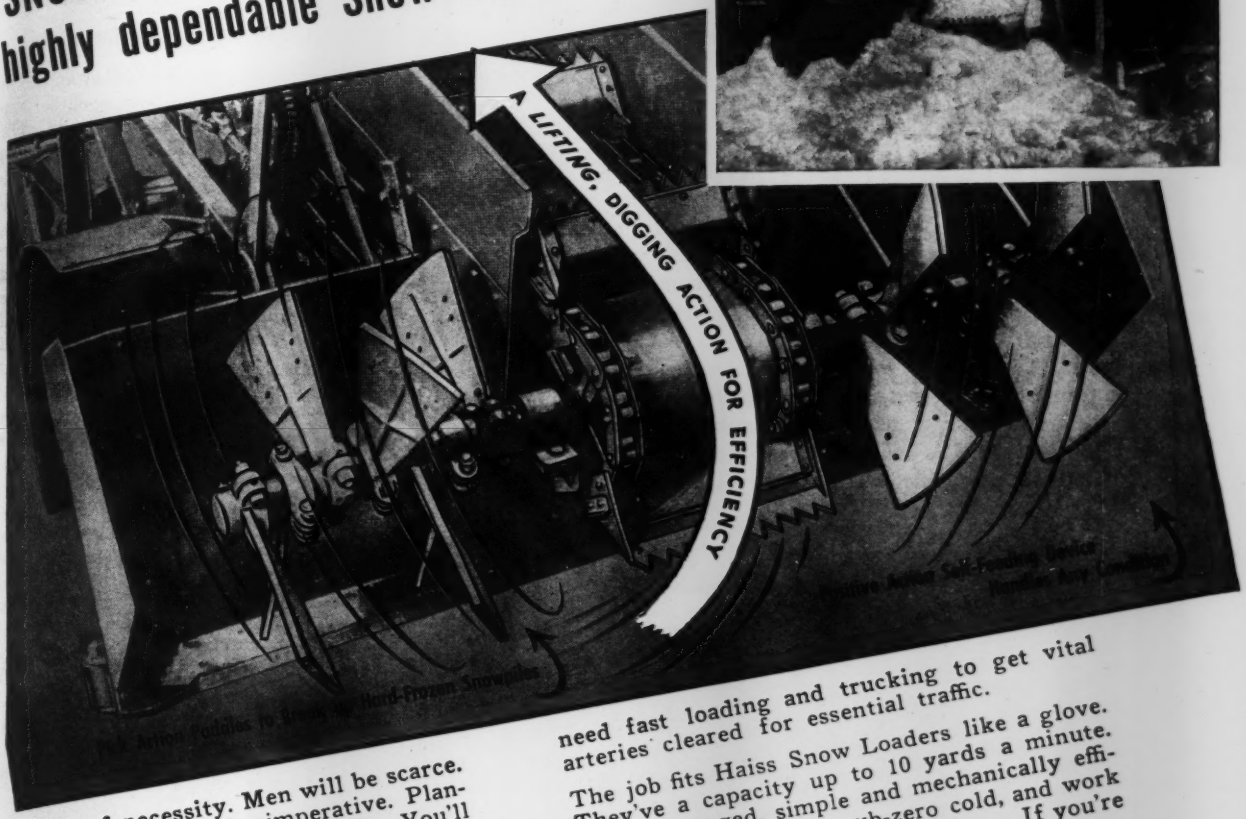


Feeder

This 39,000 lb. heavy duty Telsmith feeder has been shipped to Panama for work in connection with the new set of locks at the Panama Canal. The feeder is 6 ft. wide by 12 ft. long and will feed rock to a 66-in. by 84-in. jaw crusher

CLEAR THE WAY . . .

Defense-busy Cities will need FAST SNOW REMOVAL . . . high-capacity, highly dependable Snow Loaders.



This is a year of necessity. Men will be scarce. Mechanical loading will be imperative. Planning ahead means ACTION NOW. You'll need fast loading and trucking to get vital arteries cleared for essential traffic.

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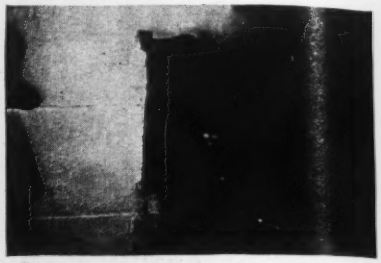
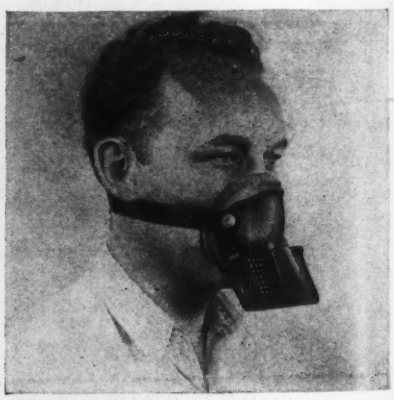
enabling the operator to quickly control flow of material to the crusher.—*Smith Engineering Works, Milwaukee, Wisc.*



Waterproofing a Building

A pulverized asphalt product known as U-Mix-It has recently been used for waterproofing leaky concrete blocks. The U-Mix-It is a blend of high melting point and natural asphalts delivered to the job in paper bags. It is then mixed with solvents to the proper consistency for brush, trowel or spray application. This material serves as a positive waterproofing and sealing compound. The procedure is to wire brush the walls to remove all loose particles then use a prime coat of U-Mix-It. After the priming coat soaks into the masonry a second coat is applied in which, shown above, white sand is added in the proportion of one to one with the U-Mix-It. This material is applied approximately ⅛ in. thick and completely seals the wall. To restore the building to a light color, this material is then painted over with a finishing coat of water base cement-paint. One pound of U-Mix-It covered about 10 sq. ft. ⅛ in. thick, and at a cost of 8 cents per pound made a very inexpensive durable coating. The U-Mix-It and asbestos, using No. 5 fuel oil as a solvent, has been used satisfactorily for calking materials for windows, remaining soft and pliable in place. —*Allied Asphalt & Mineral Corp., New York, N. Y.*



Respirator

M.S.A. has a new single filter "Dustfoe" respirator. The single filter replaces a two-part, (felt screen and cellu-

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. . . guns *and* bread! Whatever the job, whether for war or peace, Arkwright tracing cloths need make no compromise with quality. Years of testing in Arkwright laboratories . . . years of insistence on highest quality materials and highest standards of manufacture have prepared Arkwright for any national emergency. Today, you can order Arkwright tracing cloths with the same confidence in quality . . . the same assurance of rapid delivery that has given Arkwright its recognized position as America's leading manufacturer of tracing cloth for over twenty years! Arkwright Finishing Company, Providence, Rhode Island.

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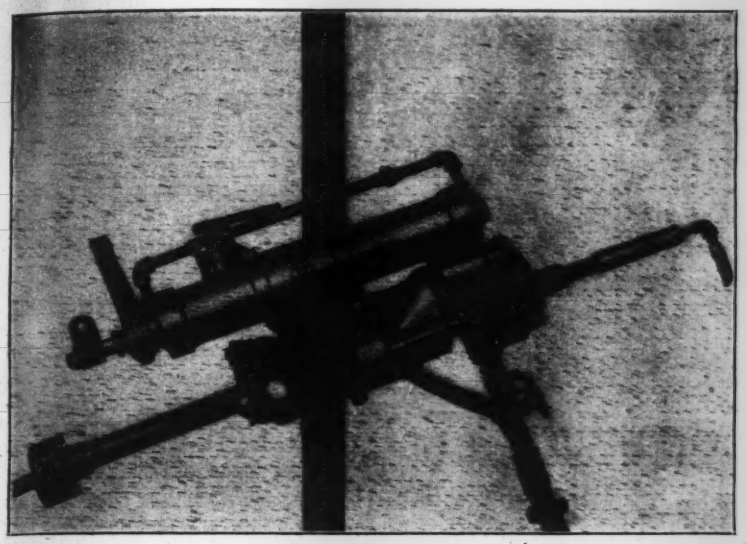
NEW LIGHT-WEIGHT DIAMOND CORE DRILL



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NEW YORK—New from the ground up CP No. 5 Diamond Core Drill is faster and lighter than any other diamond core drill of the same capacity. Weight and air consumption are about the same as those of a 3½" drifter with the same 24-inch change. Ideal for short hole prospecting, underground, wall sampling, etc. Particularly adapted to long hole drilling in drawing pillars; equally good for "blast hole" drilling in drifts and stopes where conditions are favorable to that type of drilling.

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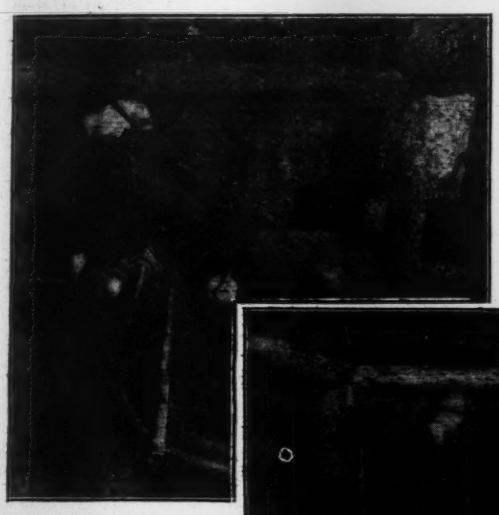

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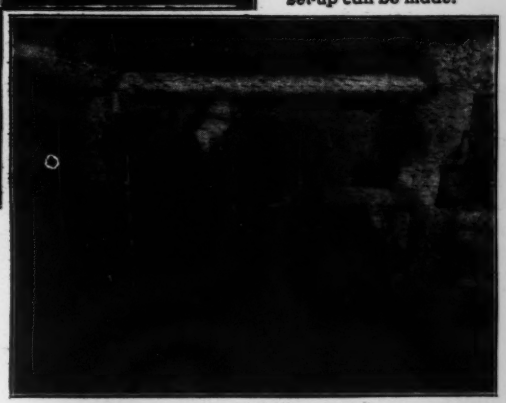
MOUNTS LIKE A DRIFTER ← on any rock saddle and works in any position from a column, arm or crossbar. Can be operated wherever a drifter set-up can be made.



BIT SPEEDS UP TO 1500 R.P.M., with stepless → throttle regulation. Balanced design, smooth rotary power, minimum rod vibration mean greater footage per shift, lower drilling costs per foot.

↑ **WORTHY TEAM MATE** of this CP-60 MOTORdrifter, CP No. 5 Diamond Core Drill, with its high speed and maximum core recovery, makes underground diamond drilling easier, faster and cheaper.

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ROCK DRILLS

ALSO: Air Compressors, Pneumatic Tools, Electric Tools, Diesel Engines, Hydraulic Aviation Accessories

DRIFTERS
MOTORdrifters
AUTOdrifters
SINKER DRILLS
WAGON DRILLS
DIAMOND CORE DRILLS

ECONOMICAL DURABLE
WATER-TIGHT ROOT-REPELLENT

Sewer Pipe Joint Compounds
by SERVICISED

- HOT-POURING COMPOUND—an inexpensive, asphaltic preparation, carefully compounded into a uniform and easy-to-work-with material.
- TUFFLEX—cold trowelling plastic—really saves you money as it arrives at the job mixed, ready for immediate use. You save because your labor cost is reduced.
- PREMOULDED SEWER PIPE BELT—a modern product manufactured to give you 100% filled, strong, water-tight, plastic, root- and acid-resistant joints.
- TWO-IN-ONE DIE CAST COMPOUND—the latest development in sewer pipe joints. It's quicker, easier, faster, and a better method of making sewer pipe joints.

Write to us today for samples and prices that will interest you.

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6055 W. 65th STREET — CHICAGO, ILLINOIS

WILLIAMS *Buckets*

Welded Rolled Steel Construction

All types and capacities for all conditions. Send for Catalog.

The Wellman Engineering Company
7000 Central Ave., Cleveland, O.

built by WELLMAN

THE MOUNT VERNON BRIDGE CO.

Engineers Contractors

STRUCTURAL STEEL
RAILWAY AND HIGHWAY BRIDGES
BUILDINGS AND VIADUCTS

MOUNT VERNON, OHIO

lose) filter used previously, yet gives approved protection against an even broader range of dusts and mists. Total weight of the complete outfit is 3¾ oz., full vision is claimed in every direction, and has low breathing resistance.—*Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa.*

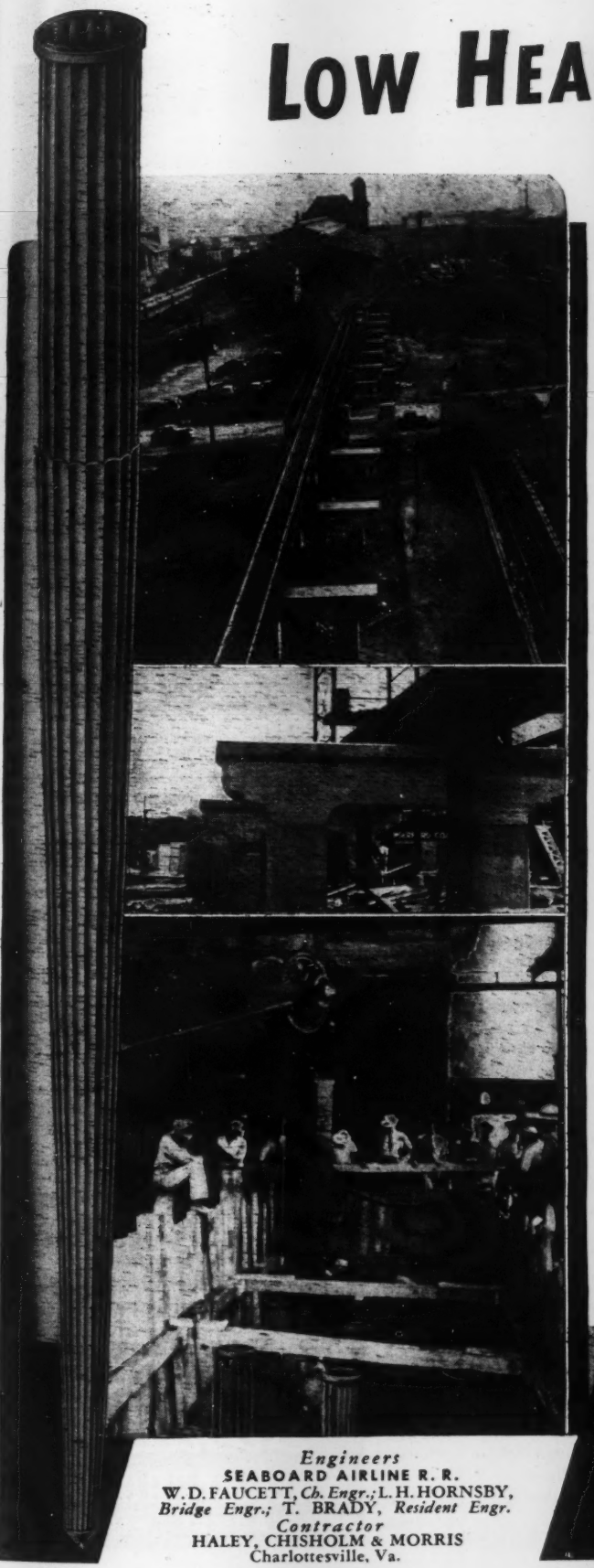
Speedy Whiteprint Machine

Ozalid's new Model "B" Whitprint Machine, especially designed to meet industry's heaviest print making demands, is capable of producing finished whiteprint as speeds up to 20 ft. per min., the fastest speed in dry developed print making. This new machine contains such features as synchronized printing and developing, permitting use of continuous yardage as well as cut sheets, a temperature control for the printing cylinder so that the entire range of Ozalid sensitized materials can be printed with maximum results, and a special light conveniently placed above the print receiving tray enabling the operator to check prints for correct printing and developing speeds when the prints are delivered at the rear of the machine. This machine, as all other Ozalid white printers, combines printer and developer in one neat and compact unit.—*Ozalid Products Division, General Aniline and Film Corporation, Johnson City, N. Y.*

Roof Pitch Card

A new pitch card that contains complete instructions for use as well as condensed estimating data is available at no cost to those requesting it. With this pitch card, roofs of 1:4, 2:5, 1:3, 1:2 and 3:4 pitch are readily identified. Tables contained on the card enables the user to determine many common rafter lengths immediately after the width of the roof and its pitch are obtained. Simple instructions for determining the area of the roof to be covered are also given.—*United States Gypsum Co., Chicago, Ill.*

LOW HEADROOM Caused No Headaches On This Piling Job!



Extendable Monotubes Permit Installation of Elevated Track "Under Traffic" With Big Time and Money Savings

CONSTRUCTION of this 4000-ft. elevated track and viaduct in Richmond, Va., by the Seaboard Airline Railway presented a major piling problem. Plans called for building the structure under the present tracks, which meant driving many of the piles for the 59 piers in locations offering only about 20 ft. of headroom. Only a sectional pile could be used if traffic was to be maintained. Otherwise, traffic would have to be rerouted and portions of the old structure removed at a tremendous cost in both time and money.

Use of Union Metal Extendable Monotubes proved to be the practical solution. 800 of these tapered steel casings, averaging 20 ft. in length, were driven in 10-ft. sections. Despite difficult working conditions, installation of the finished cast-in-place piles was completed in about 50 working days.

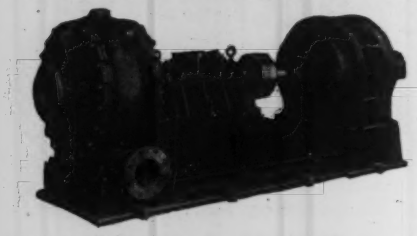
The principle of Extendable Monotubes is just this—you drive the main lower tapered section, then add constant taper sections to obtain the desired total length. Any number of extensions, which are available in 12″, 14″, 16″ and 18″ diameters, can be added to produce a cast-in-place concrete pile of the exact length required—thus eliminating unnecessary waste and permitting installation in low headroom areas. Write today for catalog describing Extendable Monotubes—they can speed your job and save you money.

Engineers
SEABOARD AIRLINE R. R.
W. D. FAUCETT, *Ch. Engr.*; L. H. HORNSBY, *Bridge Engr.*; T. BRADY, *Resident Engr.*
Contractor
HALEY, CHISHOLM & MORRIS
Charlottesville, Va.

THE UNION METAL MANUFACTURING CO.
CANTON, OHIO

The MORRIS HYDRAULIC COLUMN

News of interest to Centrifugal Pump Users



For longer service from your dredging and materials-handling pumps

Material-handling pumps are naturally subject to severe wear. Impellers, wearing rings, shaft sleeves, shell liners are continuously abraded by the grinding and scouring action of the material being handled. The result . . . usually early and frequent replacement of parts or complete new units.

For three generations, Morris has been developing designs and materials to retard this wear. Today, when new equipment is so hard to get, this long experience is at your service to help you in the essential conservation of your present pumps.

If you are troubled with rapid wear of your centrifugal pumps . . . whether Morris or other design . . . consult the Morris engineers. They will advise you authoritatively and frankly how you can get longest service from your pumping equipment and how you can maintain highest possible efficiency.

MEMBER

For authoritative recommendations on any pumping or dredging problem, write to Morris Machine Works, Baldwinsville, N. Y. Representatives in principal localities. *Export Office*, 50 Church St., New York.

NEW PUBLICATIONS

Available Shapes—A booklet listing the simplified range of Bethlehem Structural Shapes is available giving the sizes now being rolled in accord with the Office of Production Management's request for elimination of non-essential shapes. The booklet, suitable for insertion in Catalogue S-51, will be sent on request to the nearest district office.—*Bethlehem Steel Co., Bethlehem, Pa.*

Rechargeable Battery—A new folder describes the Ideal storage battery for use in standard flashlight cases, taking the place of two 1¼ in. size dry cells.—*Ideal Commutator Dresser Co., 1273 Park Ave., Sycamore, Ill.*

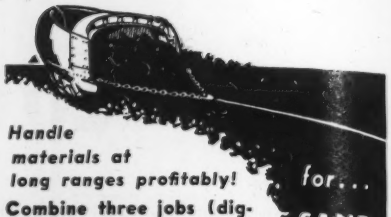
Jeffrey—Jeffrey equipment for the Process Industries is described in a new catalog. Illustrated and accompanied by brief specifications are feeders, conveyors, elevators, process equipment, screens, crushers, power transmission machinery, and portable loading and stacker units.—*The Jeffrey Manufacturing Co., Columbus, Ohio.*

Wrench Handy Guide — Describes sockets, box-type, specialty and torque indicating wrenches, their uses and new features. 48 pages. Pocket-size.—*Blackhawk Mfg. Co., Milwaukee, Wis.*

Vacuum Concrete — Four pamphlets are available describing "Vacuum Concrete for the Engineer," "The Vacuum Concrete Process," "Vacuum Concrete, Step-by-Step" and "Vacuum Concrete, Speed and Economy for the Contractor." These pamphlets explain the engineering principles involved and economies available to the contractor in using vacuum equipment to remove excess moisture from fresh concrete to reduce the time required for finishing concrete and to increase its strength.—*Vacuum Concrete, Inc., 4210 Sansom St., Philadelphia, Pa.*

Castings—A 12 page bulletin entitled "Meehanite Castings in Defense Work" describes and illustrates castings used in aircraft manufacture, gun and shell manufacture, machine tool castings, marine, truck and steel mill equipment.—*Meehanite Research Institute of America, Inc., 311 Ross St., Pittsburgh, Penna.*

Pumps — "Thrustfree" centrifugal pumps in two- and three-stage units are described in an 8-page folder. Photos and line drawings illustrate the pumps and passage of water through them. Ask for Bulletin No. 237.—*Pennsylvania Pump and Compressor Co., Easton, Pa.*



Handle materials at long ranges profitably!

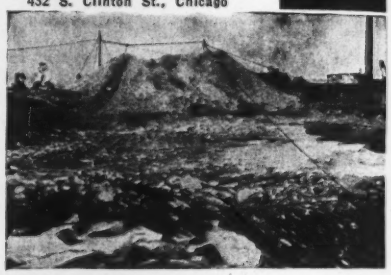
for... SAND GRAVEL STONE COAL ORE

Combine three jobs (digging, hauling and placing) into one economical operation.

A SAUERMAN Scraper penetrates hard materials with the ease of a plow-share, and both in digging and conveying it requires much less line-pull than any other scraper of equal rated capacity. It digs a heaping load in a few seconds, moves this load rapidly over the ground, dumps cleanly when it reaches the dumping point and then returns at high speed for another load.

For full details of SAUERMAN Scrapers, handling capacities, methods of operation, etc., etc., write for Bulletin 147.

SAUERMAN BROS. INC.
432 S. Clinton St., Chicago



Small Sauerman Scraper strips overburden from ore deposit at rate of 60 cu. yd. per hour, placing the spoil in a high pile.

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BALANCED WHEELBARROWS FOR ALL PURPOSES

S12 — DRY MATERIAL
Standard Barrow Has Steel Wheels

Wood or Tubular Frames

Butt-Welded Rod in Top Edge of Trays

Furnished With Solid Rubber or Pneumatic Tires as Shown

Sterling
WHEELBARROW CO.
MILWAUKEE, WISCONSIN

Protective Coatings—A 40-page loose leaf booklet describes the products of the Tocol line of protective coatings for metal, concrete, stucco, wood, paper, fabrics, etc.—*Protective Coatings, Inc. 10391 Northlawn, Detroit, Mich.*

Weir Meter—A brief bulletin describes the Foxboro float-and-cable operated weir meter. This instrument was specially designed for problems met in sewage disposal systems and public health engineering.—*The Foxboro Co., Foxboro, Mass.*

Air Conditioning—Three new folders, "Patrons Won't Tolerate CSC", "When Production Is Cramped by the Weather," and "There's Trouble in the Air," represent new literature on humidifying and dehumidifying equipment manufactured under the name "Kathabar."—*Surface Combustion Corp., Toledo, Ohio.*

Termite Protection—The second edition of a handbook entitled "Protection Against Termites with Copper Shields" is available to architects and sheet metal workers. This book shows the proper application of sheet copper for termite protection. Copies may be obtained without cost.—*Copper & Brass Research Association, 420 Lexington Ave., New York, N. Y.*

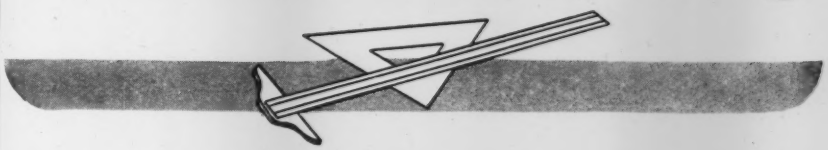
Safety Equipment—A new 111-page safety equipment catalog describes equipment for complete protection from head to ankles provided by industrial goggles, Calobar lenses, Super Armorplate lenses, welding lenses, welding plates, welding helmets and hand shields, safety clothing, respirators, first-aid kits, etc.—*American Optical Co., Southbridge, Mass.*

Variable Speed Drive—Bulletin No. 501 is available as a technical guide for engineers who design and specify machinery and has the title of "When to Use the Graham for the Variable Speed Drive." The bulletin includes an outline of the laws of metallic traction and gives complete information on mechanical drives.—*Graham Transmissions Inc., 2711 N. 13th St., Milwaukee, Wis.*

Industrial Controls—Catalog No. 8301 describes the industrial control devices of Minneapolis-Honeywell Regulator Co. —*Brown Instrument Co., Philadelphia.*

Timber Fastenings—The hurricane brace is described in a catalogue and mimeographed design sheets which describe and illustrate the advantage of steel brackets in connection with joists and rafters making permanently tied joints in timber construction.—*Structural Specialties, Inc., 614 Guaranty Building, West Palm Beach, Fla.*

Designed to make service easy



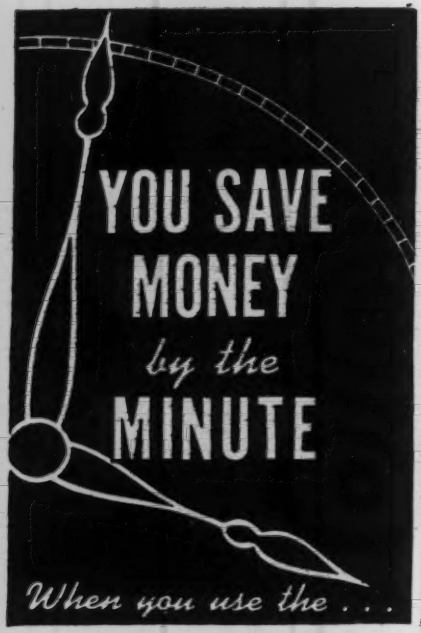
Your job today is to keep production moving at top speed . . . despite shortages in new equipment and skilled mechanics to take care of your service requirements. Our job is to give you economical, dependable power which will overcome these handicaps and we are doing it by incorporating in the Cummins Dependable Diesel, every feature of design that will make your service needs less frequent . . . easier, cheaper and faster to meet.

In the Cummins Diesel, all accessories are removable as a unit . . . bearings, wet-to-the-top cylinder liners and other parts subject to wear are replaceable without tearing down the engine . . . the Exclusive Cummins Fuel System is simply designed and factory-adjusted, easy to understand and service.

These "easy-to-service" features are important reasons why leading contractors standardize on Cummins Diesel power . . . they are important reasons why you can save time and money and reduce your work interruptions by specifying Cummins Dependable Diesels.

ILLUSTRATED: *Model HBI-600 Cummins Dependable Diesel. 150 hp. at 1800 rpm. Other models from 33 to 325 hp.*

CUMMINS ENGINE CO., COLUMBUS, IND.



SUPER-VULCAN OPEN-TYPE
DIFFERENTIAL-ACTING
PILE HAMMER
18C, 30C, 50C and 80C

The Super-Vulcan gives you twice the blows per minute — therefore, you not only gain in time but drive more piles per dollar. In doing all this your Super-Vulcan uses 25% to 35% less steam per blow.

Be better prepared for those new construction pile driving jobs — do them at less cost—faster — easier.

The Super-Vulcan Open-Type fits same leaders—uses same accessories as Vulcan Single-Acting Pile Hammers and has same widely approved characteristics.

Write today for complete details.

Sizes 18C—30C—50C—80C meet all needs

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331 North Bell Avenue
Chicago Illinois

Steel Shapes—A 16 page booklet designed to bring to the attention of the purchasing agent and design engineer a number of standard steel shapes which can be purchased as production items without die or tool charges is available. The booklet features cold forming and working of steel parts produced by the process.—*The Commercial Shearing & Stamping Co., Youngstown, Ohio.*

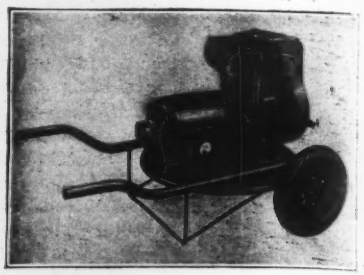
Bristol Co.—The Bristol Co. has just published a bulletin containing a condensed index of the products they manufacture and of their engineering services. The bulletin covers air-operated and electrically operated automatic control instruments, recording and indicating instruments, and telemetering instruments for recording and remote automatic control.—*Bristol Co., Waterbury, Conn.*

Portable Tools—A new folder describes the Mall jack-of-all-trades gas engine, an all-round tool for concrete vibrating, surfacing, sawing, sanding, etc.; another covers the entire Mall portable power tool line which includes saws, drills, vibrators and other equipment.—*Mall Tool Co., 7740 So. Chicago Ave., Chicago, Ill.*

Material Processing—The Cedarapids line has recently issued a series of one page catalog sheets describing their Portable Horizontal Screening Plant; stone crusher outfit; the Pitmaster, portable crushing plant; portable washing plant; and a big primary-25x40 portable jaw crusher and heavy duty steel apron rock feeder. Also new is a bulletin describing the Cedarapids "traction broom," a power drawn sweeper for street work.—*Iowa Mfg. Co., Cedar Rapids, Iowa.*

Barber-Greene—An attractive and well illustrated folder features the silver anniversary of the Barber-Greene Co. Photographs show early machines and early personnel of the company and illustrate many of the famous "firsts" which Barber-Greene originated. The latter part of the book shows modern equipment used on modern work. The book is in two colors—yes, one of them is Barber green.—*Barber-Greene Co., Aurora, Ill.*

Pumps—Pumps for chemicals and proportioning are described in a well-illustrated 16-page catalog that contains much useful information for chemical, refinery, power plant, water works and other plant pumping problems. A simplified chart helps in selecting the right pump for a specific duty.—*Milton Roy Pumps, 1360 E. Mermaid Ave., Philadelphia, Pa.*



For Immediate Delivery
PORTABLE GENERATOR SETS
Capacities 500 Watts to 9400 Watts

Master offers 21 Standard sizes of continuous-duty, ruggedly-built, gas-powered Generator Plants, to furnish power for lighting, saws, tools and Master Electric Vibrators, and other standard electrically powered equipment within the scope of a given generator size.

MANUFACTURERS OF
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- Concrete Surfacing Attachments.
- Master Power Blow Hammers & Tools.
- Complete Line of High Speed Tools.

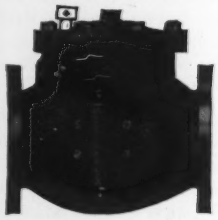
Master Distributors throughout United States and Canada. All Foreign territories—Armco International Corporation.

Send for #504 Bulletin today.

Master Vibrator Co., Dayton, Ohio

GOLDEN-ANDERSON
AUTOMATIC WATER CONTROL EQUIPMENT

. . . CUSHIONED SWING CHECK VALVES



For water lines, air compressor lines, etc. . . . here's a G-A swing check valve that's *built to serve!* It provides balanced operation, with assured full pipe line flow with minimum pressure drop. Has specially arranged cushion chamber on side to prevent banging of disc against seat on reverse flow. In 4" to 36" sizes . . . cast iron, semi-steel and cast steel, with bronze, Gavalloy or stainless steel trim. Globe pattern only. Make this GOLDEN-ANDERSON valve your choice for check valve service. For more detailed information, write for catalog No. 26.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
FULTON BLDG.
PITTSBURGH - - - PENNA.

Manufacturers' Activities

THE TIMKEN ROLLER BEARING CO., Canton, Ohio, has revitalized the old Savannah Ave. plant (21,000 sq. ft.) for the exclusive purpose of manufacturing the 37-mm. shot.

Announcement has been made that the recently organized KOTAL CO., headed by HOWARD B. BISHOP of Summit, N. J., has acquired the business heretofore conducted by the ASPHALT TREATMENT CORP. at 140 Cedar St., New York City. The new company, which is moving into new offices at 52 Vanderbilt Ave., New York, on Jan. 1, manufactures a waterproofing agent for use on aggregates employed in asphalt highway construction and maintenance.

The downtown office of SKILSAW, INC. is now at 121 West Wacker Drive, Chicago.

JOHN A. ROEBLING'S SONS CO., Trenton, N. J., has announced the appointment of EUGENE KING as manager of the Cleveland branch of the company, succeeding RAYMOND R. NEWELL, who retired Dec. 1 after 39 years of service with the company. Mr. King, who was formerly assistant manager of the Cleveland branch, has been with the company since 1917.

GILBERT H. TOMPKINS, secretary of SAUERMAN BROS. INC., Chicago, Ill., died on Dec. 2. He had been with the company for 32 years.

THE HARNISCHFEGER CORP. of Milwaukee has announced the appointment of the WESTERN EQUIPMENT & SUPPLY CO., Rock Island, Ill., as agent for P&H excavators. EDMUND A. ORRELL, recently zone manager for White Motor Truck Co., has been appointed district manager in the Raleigh, N. C. territory for the Airtemp division of Chrysler Corp.

THE NATIONAL BUREAU OF STANDARDS has announced that the effective date for production of diamond core drill fittings under Commercial Standard CS17-42, has been extended to Jan. 1, 1943.

HARVEY L. WILLIAMS, JR. has joined the HAWKINS-HAMILTON CO., Richmond, Va., and will be responsible for sales engineering work in the Richmond, Va., territory. For the past ten years Mr. Williams has been associated with A. M. Gathright & Co. in air conditioning work.

A new Simplified Practice Recommendation has been announced by the National Bureau of Standards for Pipe Fittings covering sizes of grey cast iron, malleable

FAIRBANKS-MORSE PUMP

Serves Oldest Incorporated Town in Washington

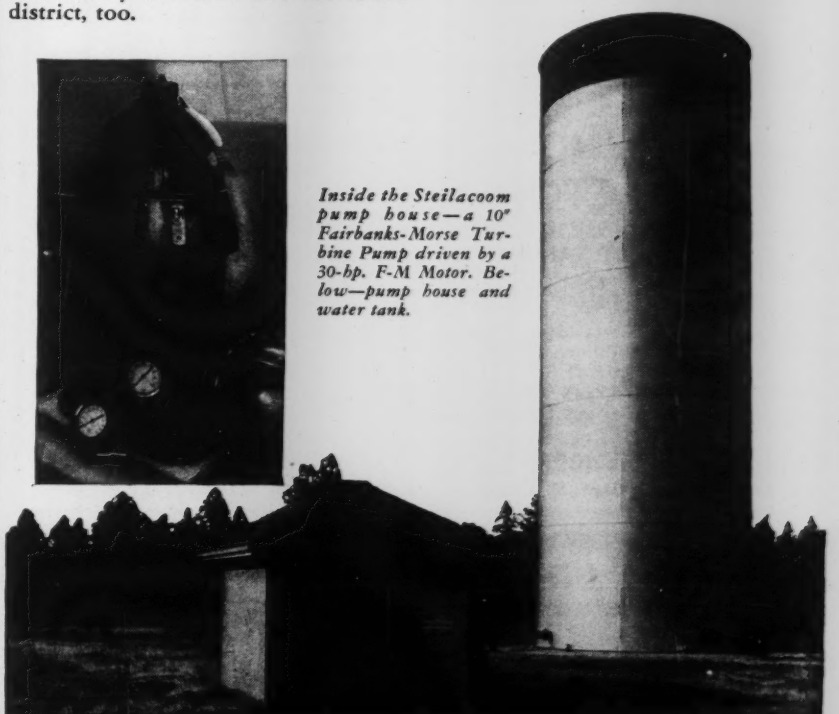
FOR years the lower section of Steilacoom, Washington, received its water by gravity from springs, while the hill district was supplied by repumping from the reservoir to a tank on a hill.

By 1939 increased demand had made expansion necessary. So a 10″, 140′ well was drilled on the hill near the tank. A 10″, 5-stage Fairbanks-Morse Turbine Pump driven by a 30-hp. F-M Motor was set in the well at about 100′. Starting and stopping are automatic, controlled from the tank by a float switch. Should need arise, the new hill system can serve the lower district, too.

Your pumping conditions may call for entirely different solution. But you'll find highly efficient pumps of the right type and capacity in the *complete* Fairbanks-Morse line. And from F-M you'll get the conscientious counsel of a fully informed representative —counsel that makes for successful, economical installations.

Write Fairbanks, Morse & Co., Dept. L29, 600 S. Michigan Ave., Chicago. Branches and service stations throughout the United States and Canada.

Inside the Steilacoom pump house—a 10″ Fairbanks-Morse Turbine Pump driven by a 30-hp. F-M Motor. Below—pump house and water tank.



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Pumps

WHAT DO YOU WANT IN A TRAILER?

headroom clearance
road clearance
OR-traffic clearance

ROGERS builds trailers of every type of a design that has been thoroughly proved under every conceivable condition of difficult service.

Scientific design, based upon long experience, alloy steel and electric welding produce trailers that have an envious record for long service with remarkable freedom from repairs. Get the NEW catalog.

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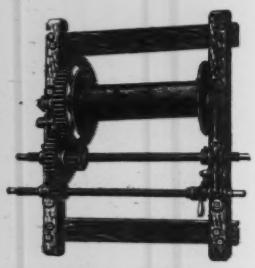
EXPERIENCE *builds 'em* PERFORMANCE *sells 'em*

DOBBIE



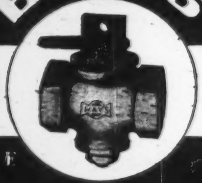
Dobbie Foundry & Machine Co.
Niagara Falls, N. Y.
Derricks • Winches • Sheaves

BAILEY METERS AND CONTROLLERS
FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

• Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

BAILEY METER COMPANY
1029 IVANHOE ROAD • CLEVELAND, O.
Bailey Meter Co. Ltd., Montreal, Canada

HAYS GAS SERVICE
BRASS



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SINCE 1869
HAYS MFG. CO., ERIE, PA.

DRILLING CONTRACTORS
DIAMOND AND SHOT CORE BORINGS—DRY SAMPLE BORINGS
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Foundation Testing for Bridges, Dams and All Heavy Structures
Also
Manufacturers of Diamond and Shot Core Drills, Accessories and Equipment
•
SPRAGUE & HENWOOD, Inc.
SCRANTON, PA. Dept. E U. S. A.

The PHOENIX BRIDGE CO.
BRIDGES and BUILDINGS
General Office and Works
Phoenixville, Pa.
District Offices
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Washington, D. C.

We Look Into the Earth

• By using Diamond Core Drills we prospect Coal and Mineral Lands. We are fully equipped for testing foundations for bridges, dams, buildings, and all work of a similar character.

PENNSYLVANIA DRILLING CO.
Drilling Contractors
PITTSBURGH - - - - PA.

OWENS *Dig In'* FOR DEFENSE

A MOUTHFUL AT EVERY BITE

The OWEN BUCKET *Co.*
6010 BREAKWATER AVE. CLEVELAND, OHIO
BRANCHES: New York, Philadelphia, Chicago, Berkeley, Cal.

iron, and brass or bronze fittings recommended for production as regular stock items and will be effective for new production from Jan. 1, 1942. Simplification of valves will be effective on the same date for brass, bronze and iron body, globe, angle, gate and check valves.

CHAIN BELT CO., Milwaukee, Wis., announces the appointment of DOW & CO. INC., 1820 Elmwood Ave., Buffalo, N. Y., as distributor of REX construction equipment in the Buffalo and Rochester area.

KINNEY MFG. CO., Boston, has appointed HAROLD G. SAUNDERS as manager of their Philadelphia office in place of C. D. CAMPBELL, JR., who has resigned. Mr. Saunders has been with the company for 22 years as district manager at Kansas City, Mo. and Dallas, Tex. HENRY A. PERRY, JR., of the Boston office, has taken Mr. Saunders' place at Dallas.

ALLEN BILLMYRE CORP., manufacturers of pneumatic equipment, has announced new larger quarters at 431 Fayette Ave., Mamaroneck, N. Y.

NORMAN E. DONNELLY is now marine sales manager for the Buda Co., succeeding FRANK FLICK. For the past seven years Mr. Donnelly has been with the Caterpillar Tractor Co. as their eastern engine sales manager.

CARL C. BROWN, 57, retired Birmingham district sales manager for Republic Steel Corp., died in November at his home in Birmingham.

WILLIAM W. MEIN, JR., purchasing agent for the Calaveras Cement Co., San Francisco, has been promoted to vice president and a member of the operating committee. The plant, which makes the only white portland cement in the West, is producing at an all-time peak for defense projects.

VERNON CLARK, field service man for the Koehring Co., Milwaukee, for 20 years, died in November, at his home in Milwaukee.

ALBERT Q. DUFOUR, Wisconsin district sales manager for the Jeffrey Mfg. Co., Columbus, Ohio, died in November at Milwaukee. He was a native of Pittsburgh and came to Milwaukee in 1910.

LINCOLN ELECTRIC CO. of Cleveland, Ohio, announces the opening of a new office in Jacksonville, Fla. under the direction of J. M. CHAPPLE, who until recently was with the Detroit office of the company.

LINK-BELT SPEEDER CORP. announces the appointment of EIGHMY EQUIPMENT CO., Rockford, Ill., as distributor for the complete line of Link-Belt Speeder shovels-draglines-cranes.

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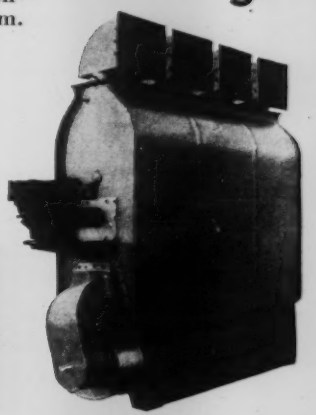

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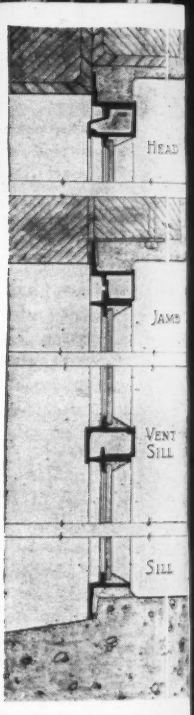

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CONSTRUCTION REPORTS

Compiled by Business News Department—Engineering News-Record, 330 W. 42nd St., New York
ELSIE EAVES, Manager *SCOTT McLEOD, Statistician*
(Daily service also available—Write for details)

Location of ENR Correspondents

Symbols and Abbreviations Include:

† Federal Government
★ Project of $500,000 or over
ENR Engineering News-Record
CD Engineering News-Record Construction Daily

Projects—By Size

Construction projects here reported cover the United States and Canada, are of these minimum sizes or larger: water supply, earthwork, waterworks, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

Classes of Construction

(Named in order of Listing)

Water Supply — Unclassified
Sewers, Waste Disposal — Latin America
Bridges, Grade Cross'gs — Public Buildings
Streets & Roads — Commercial Buildings
Earthwork, Waterways — Industrial Buildings

Stages Reported

PROPOSED: (except Streets & Roads):

BIDS ASKED (new announcements only. For full calendar, see also preceding issues of ENR);

LOW BIDDERS: All low bidder news will be the final reports published on the projects involved except where award is not made to the low bidder. In this case, a supplementary contract award report will be published.

CONTRACTS AWARDED: Except awards to low bidders previously reported in low bidder stage.

Dates shown are of issue in which last previous report was published.

WATER SUPPLY

PROPOSED WORK

Idaho, Basalt—Water sys. $30,000. WPA funds sought.

★**†Mass., Springfield**—City, E. Lochridge, ch. engr., Bd. Water Comrs., 40,000 lin. ft. 60 in. steel supply line from West Parish Filtration Plant to Brevin Mountain Reservoir, Docket Mass. 19-106. $1,000,000. **DPW.** CD 12/3—ENR 12/11.

N. Y., Walton—Walton Water Co., rehabilitating, imprv., exten. WW. Over $15,000.

★**†Okla., Tulsa**—City voted bonds 1,800 ft. 36 in. force feeder main and enlarging filter plant, Docket Okla. 34-105. $558,895. **DPW.** W. R. Wooten, City Hall, engr. CD 11/13—ENR 11/20.

Okla., Wagoner—Preliminary plans made WW imprvs. $100,000. Applied for DPW gr. T. P. Clonts, Muskogee, engr.

Pa., Bethlehem—B. Nagle, city clk., 3,408 ft. 6 in. c.i. watermain, Williams St., 120 ft. Montrose Ave., 204 ft. Langhorne Ave. $15,000. R. L. Fox, city engr.

Tenn., Gatlinburg—E. Ogle, mayor, water and sewerage sys. $75,000.

Wash., Longview and **Kelso**—Towns water filter plant. J. L. Henderson, City Hall, Vancouver, engr.

Ont., Hamilton—Dominion Govt., Ottawa, pump. sta., in mountain. $15,000. Dpt. Air Defense, archts. and Dpt. Munitions & Supply, engrs., both Ottawa.

Ont., Kingston—Gore & Storrie, engrs., 1130 Bay St., Toronto, bids soon installing pump. facilities, Booth coal yard property, in connection with WW imprv. program, for City. $202,000.

Ont., Whitby—Municipality, c/o Pub. Utilities Comn., H. L. Pringle, supt., water and sewer services to wartime housing site. $30,000. Wartime Housing, Ltd., 55 York St., Toronto, engrs.

Que., Ste. Therese—City Gas & Electric Corp. Ltd., Ste. Therese, WW imprvs. $25,000.

BIDS ASKED

Bids Asked December 23

Mich., Fenton—City Clerk, motor driven WW. pump. equip. $15,000. Francis Eng. Co., 303 3-4 Eddy Bldg., Saginaw, engrs.

Bids Asked December 29

Tex., Port Lavaca—F. M. Dudgeon, mayor, WW. imprvs. $29,000. F. G. Huffman, Port Lavaca, engr.

Bids Asked December 30

†Tex., Abilene—City, W. W. Hair, mayor, WW imprvs., Lake Abilene earth filled dam imprvs., Tex. 41-176. $30,000. **DPW.** Freese & Nichols, Capps Bldg., Fort Worth, engrs. CD 11/7—ENR 11/13.

Bids Asked About January 15

†Md., Aberdeen Proving Ground—U. S. Eng., 1 and Douglas Sts., N.W., Wash., D.C., water supply, sewerage sys. $150,000. R. T. Regester, 401 E. Gittings Ave., Baltimore, consult. engr.

LOW BIDDERS

†La., Camp Livingston—U. S. Eng., Camp Livingston, Nov. 28, Contr. 2, pump. station and Contr. 4, filtration plant, from C. H. Treadwell, 1523 Centenary Blvd., Shreveport, **$91,460** and **$199,000** respectively; Contr. 1, electric line, from L. O. Brayton & Co., Dyersburg, Tenn., **$47,300.** CD 11/18—ENR 11/27.

†Md., Edgewood—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., Dec. 9, water treatment plant, Edgewood Arsenal Defense Housing, from Suburban Eng. Co., 15 W. 38 St., New York, N. Y., **$22,486.** CD 11/24—ENR 11/27.

Tex., Weatherford—C. F. Russell, mayor, Dec. 6, WW. and sewer imprvs., from B. G. Welborn, 1319 Wilbur St., Dallas, about **$63,000.** CD 11/25—ENR 11/27.

Wash., Seattle — City, Dec. 4, furnishing pipe, fittings for airport way watermain, welded steel pipe, from Hydraulic Supply Mfg. Co., 7500 8 Ave. S. **$88,213.** CD 11/26—ENR 11/13.

†Wash., Tacoma — Regional DPW Office, Alaska Bldg., Seattle, Dec. 2, furnishing 3 water tanks for water sys. near Fort Lewis, for Pierce Co. Fire Dist. 2, c/o Parker & Hill, engrs., Smith Tower, Seattle, from Chicago Bridge & Iron Wks., 1305 W. 105 St., Chicago, Ill., steel **$77,400;** from C. F. Davidson, 2906 S. 9 St., rein.-con., **$48,600.** CD 11/26.

CONTRACTS AWARDED

Ala., Florence—S. C. Harlan, city comr., City Hall, expanding, imprv. water filtration plant, to Pressure Concrete Co., 6 Ave. B, Newark, N. J. **$86,076.** Est. $90,000. Awarded 12/5.

Ark., Gurdon—Missouri—Pacific R.R. Co., F. E. Bates, ch. engr., Mo. Pacific Bldg., St. Louis, Mo., 16 in. watermain from pump. station to standpipe. Owner builds. G. S. Lutley, in charge. **$25,000.**

Calif., Los Angeles—Bureau Water & Power Dpt., 207 S. Bway., 2 story, 45x94 ft., rein.-con. control house, 900 E. Lomita Blvd., San Pedro dist., own forces. **$65,000.**

Me., Kittery—Trustees Kittery Water Dist., Kittery, concrete dams in connection with water supply reservoir, York, to John MacDonald Constr. Co., 215 California St., Newton, Mass. **$76,900.** Whitman & Howard, 89 Broad St., Boston, Mass., engrs.

N. J., Newark—Water Dpt., City Hall Annex, watermains, N. 5 St. and Davenport Ave., **WPA. $38,481.** W. Banks, City Hall, WPA and city engr. CD 10/27—ENR 10/30.

†N. Y., Fort Totten—Con. Q.M., 120 Wall St., New York, additional watermains, valves, etc., to Millman & Nazzaro, 215 Montague St., Brooklyn, **$16,671.** Bids 12/4. CD 12/2.

Pa., Womelsdorf—Womelsdorf Consolidated Water Co., Womelsdorf, water supply pipeline from Furnace watershed, South Mountain, into village Robesonia, etc., own forces. **$20,000.**

†Tex., Magnolia Beach—U. S. Eng., Camp Hulen, water, sewer lines, electric distr. lines, tents, etc., to Gerald Mora, 315 Sabine St., Houston. **$59,727.**

Man., North Junction (P. O. Winnipeg)—Dpt. National Defense for Air, Ottawa, Ont., water and sewer services, sewage disposal plant, Relief Intermediate Aerodrome, to Dominion Constr. Co. Ltd., 1044 Arlington St., Winnipeg. **$46,000.**

SEWERS, WASTE DISPOSAL

PROPOSED WORK

Calif., Sacramento—Made plans 2,352 lin. ft. 8- to 12-in. vitr. sewers, etc., portions Muir Way, Sutter Way, etc.

†Fla., Key West—City, sewers, Docket Fla. 8-105. $191,510. **DPW.**

†Ill., Proving Ground—U. S. Eng., Savanna Ordnance Depot, rejected bids Nov. 28 intercepting sewers, sewage treatment plant, Savanna Ordnance Depot. CD 11/18—ENR 11/20.

Miss., Winona—Imprv. sewerage sys. $25,000. J. B. Williams, Yazoo City, engr.

★**Mo., Joplin**—$300,000 bond election soon, sewage disposal plant. $570,000. Applied to DPW. H. T. Lawrence, 3244 N.W. 14 St., Oklahoma City, Okla., engr. J. J. Saunders, street comr. CD 10/8—ENR 10/16.

Neb., Plattsmouth—A. Olson, clk., sanitary sewerage sys. $25,000-$30,000.

†N. J., East Paterson—Boro, sewage receiving tank, pump. station, force main connecting station to main trunk line, pumps, Docket N.J. 28-128. $38,500. **DPW.** CD 11/5—ENR 11/13.

N. D., Grand Forks—C. J. Evanson, city clk., sewage disposal plant. $30,000.

★**Okla., Tulsa**—Voted bonds sewage disposal plant, 15,500,000 gpdc, vicinity 51 St. and Arkansas River, incl. 7½ mi. 8- to 54-in. interceptor, 3 river crossings, 5 uplift stations, one 24 in. collector main, etc. $1,037,000; storm sewers, drainage structures, 26 projects involving 36- to 84-in. sewers, $709,000; 7 sanitary sewer projects involving 8- to 24-in. pipe, $264,000. W. R. Wooten, City Hall, city engr. CD 11/13—ENR 11/20.

†Tex., Galveston — B. Harris, mayor, bids soon, incinerator plant, Tex. 41-245. $118,000. **DPW.** H. E. Burns, Box 2623, engr. Ford, Bacon & Davis, Texas City, consult. engrs. CD 12/4—ENR 12/11.

Tex., Hawkins—C. W. Crumble, mayor, surveys sanitary sewerage sys. imprvs., disposal plant. $70,000. Albert C. Moore & Co., 2404 Smith-Young Tower, San Antonio, engrs.

★**Tex., San Antonio**—C. K. Quin, mayor, expanding sanitary sewerage sys. $1,500,000. Plans application to DPW. H. R. F. Helland & E. T. Drought, Frost Bldg., J. W. Beretta Engineers, Inc., c/o NBCB, Matthews & Kenan, Smith-Young Tower, and W. E. Simpson Co., Milam Bldg., engrs.

Va., South Norfolk—Sewage plant. $150,000. L. P. Booze, archt. and C. H. Hughes, engr., both South Norfolk.

Wash., Port Orchard—Sewer Dist. 2, Court House, sewage sys. for Manette. $112,659. **DPW.** Parker & Hill, Smith Tower, Seattle, engrs.

★**Wash., Vancouver**—Storm sewerage sys., 4 main trunk lines $690,000, probably with federal funds sought. Additional work $448,000, more recommended at later date, $1,800,000, more still later. Stevens & Koon, Spalding Bldg., Portland, Ore., engrs.

BIDS ASKED

Bids Asked December 22

N. J., Bloomfield—Essex Co., Hall of Records Bldg., Newark, 15- to 42-in. rein.-con. sewer mains, grading, right-of-way new East Passaic Ave. and new Watchung Ave. $38,000. W. Stickel, Hall of Records Bldg., Newark, engr.

Bids Asked December 23

†Md., Hyattsville—Washington Suburban Sanitary Comn., Owens Ave., 1,730 ft. 24 in. and 5,650 ft. 36 in. rein.-con. sewers, Contr. 125-S; adv. ENR 12/18.

Bids Asked December 27

Que., Montreal—Executive Com., City Hall, tributary sewers. $40,000. J. E. Gauthier, city clk. H-E Division of City, 3181 Joseph St., Verdun, engr.

LOW BIDDERS

†La., De Ridder—City, Nov. 29, sewage disposal plant, from Glassell-Taylor Co., 318 Carondelet St., New Orleans, **$179,792. DPW.** CD 11/11—ENR 11/13.

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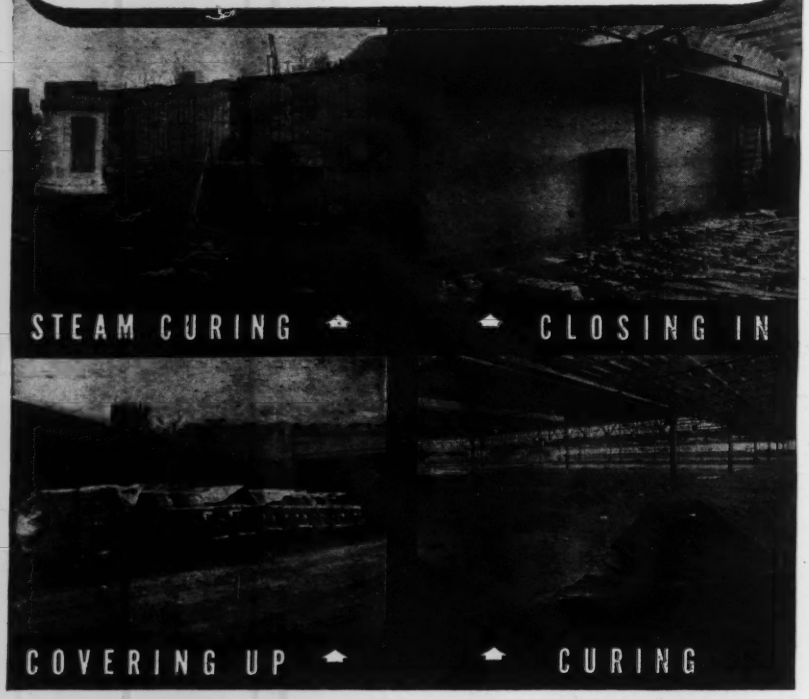

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SEWERS, etc. (Low Bidders, Cont'd.)

N. C., Wilmington—City, Dec. 9, sanitary sewer outfall exten., from A. H. Cuttz & Co., Kinney Bldg., Charlotte. **$64,6**[illegible] (base bid), **$62,187** alternate.

†**Tex., Palacios**—City, **B. F.** Balkm[illegible] city secy., Dec. 5, sanitary sewerage sys. Docket Tex. 41-103, from Gayle Bros., 808 Blodgett St., Houston. Est. **$60,000, DPW.** CD 11/24—ENR 11/27.

CONTRACTS AWARDED

Ill., Decatur—Exten. sewerage sys. **WPA. $56,000.** C. Lee, mayor. CD 11/17—ENR 11/20.

Mont., Laurel—Roselia Fritz, city clk., sewage disposal plant, **WPA. $105,400.** T. A. Rigney, city engr. CD 5/22—ENR 5/29.

N. Y., Irvington—Bd. Trustees, laying sewers, etc., **WPA. $75,000.**

★**N. Y., New York**—Dpt. P. Wks., Municipal Bldg., general construction and piping, Contrs. 4 and 5, 26 Ward Sewage Treatment Plant, to E. W. Foley, Inc., 16 Court St., Brooklyn, **$2,064,472.** Bids 11/7. CD 11/26—ENR 11/13 under LB.

O., Zanesville—Storm sewer line Virginia St., Brighton Dist. from Luck Ave. to Chapel Run, **WPA. $64,000.**

†**Okla., Dawson**—Town, complete sanitary sewerage sys., to Roy Tanner Paving Co., Tuloma Bldg., Tulsa. **$67,058. DPW.** Bids 11/26 rejected. CD 12/8—ENR 12/11 under LB.

Pa., Oil City—C. S. Hetrick, city clk., vitr. or concrete sewers, manhole covers, etc., own forces. **$25,000.** B. B. Webber, city engr. CD 12/9—ENR 12/11.

Tenn., Etowah—B. McClary, mayor, storm sewers. **WPA. $101,684.**

Tenn., Etowah—B. McClary, mayor, storm sewers. **WPA. $150,000.**

†**Tex., Goose Creek**—City, c/o E. Flowers, city atty., sewers, Docket Tex. 41-112, to Gayle Bros., 808 Blodgett St., Houston, **$43,748;** sewage plant, to P. & E. Constr. Co., 115 N. Hutchinson St., Houston, **$25,500.** Est. $75,000. Bids 12/4. **DPW.** CD 11/24—ENR 11/27.

†**Tex., Texas City**—City, c/o C. Nessler, mayor, sanitary sewers, disposal plant, Docket 41-107, to Williams & Whittle, 5422 Mockingbird Lane, Dallas. **$42,626.** Est. $40,000. **DPW.** Bids 11/18. CD 11/7.

N. S., Greenwood (Middleton)—Dpt. National Defense for Air, Ottawa, Ont., sewer and water sys., roads, walks, etc., at General Reconnaissance School, to Municipal Spraying & Contg. Co. Ltd., 1350 Barrington St., Halifax, **$92,000.**

Ont., Jarvis—Dominion Govt., Ottawa, sewage disposal plant, etc., to E. R. Clarke, 278 Douglas St., Toronto. Est. **$30,000.** Dpt. Munitions & Supply, Ottawa, engrs.

BRIDGES, GRADE CROSSINGS

PROPOSED WORK

★**Ill., Chicago**—Cook Co., County Bldg., 20 highway and 2 railroad grade separations, in imprv. **Edens Parkway** (S.A. Rte. 263), from Bryn Mawr Ave., Chicago, to Cook-Lake Co. line. **$9,000,000.** G. H. Baker, Centennial Bldg., Springfield, structural engr. co. roads and city streets.

Kansas—State Hy. Dpt., Topeka, rejected bids Nov. 19, Bridge 32.2, Cowley Co. CD 11/6—ENR 11/13.

N. J., Newark—Inter-County Bridge Comn. of Essex and Hudson Counties, Hall of Records Bldg., repairing **Bridge St.** bridge between Newark and Harrison and Belleville Bridge between Belleville and Arlington, over Passaic River. $27,400. W. Stickel, Hall of Records Bldg., engr.

New York—A. W. Brandt, supt. State Dpt. P. Wks., Albany, withdrew bids to have been opened December 18, 3 span girder bridge, concrete paving, Erie Co. CD 12/2—ENR 12/4 under Roads.

North Carolina—State Hy. & P. Wks. Comn., Raleigh, surveys bridge, causeway over Pasquotank River Swamp, Proj. 1111, near Elizabeth City, Pasquotank Co. Approx. $450,000. W. V. Baise, c/o owner, engr.

Pa., Hanover Twp. (P. O. Wilkes-Barre)—Supervs. Hanover Twp., Wilkes-Barre and Central R. R. of New Jersey, A. E. Owen, ch. engr., Reading Terminal, Phila., rebuilding bridge, hy. overpass, S. Main St. $50,000.

B. C., Squamish—Pacific Great Eastern R.R. Squamish, bridge over Namquani River. $30,000.

Ont., St. Thomas—Elgin Co., St. Thomas, steel, concrete bridge over Catfish River. $30,000. F. Bell, County Bldg., engr.

Que., Montreal—J. E. Gauthier, city clk., widening, partially reconstructing Seigneurs St. bridge. $30,000. J. A. Blanchard, City Hall, dir. P. Wks.

BIDS ASKED

Bids Asked December 31

Que., St. Sauveur des Montagnes—A. Belanger, clk., rein.-con. bridge over River Simon. $30,000. Dpt. P. Wks., Quebec City, engr.

BRIDGES, etc. (Bids Asked, Cont'd.)

Bids Asked January 2

Tex., Sinton—A. Loy Sims, mayor, concrete, timber bridges, imprv. Chiltipin Creek. Tamm & Fitzgerald, 109 S. First St., Harlingen, engrs.

Bids Asked January 6

N. Y., New York—Transit Comn., Metropolitan Div., Dpt. Pub. Serv., 270 Madison Ave., M. Nomburg, secy., bridge for proposed alteration Bronx River Parkway, crossing tracks of New York and Harlem R.R. Co.; adv. ENR 12/18.

Bids Asked January 20

†**Ark., Dyess**—Farm Security Admin., Donaghey Bldg., Little Rock, 2,700 lin. ft. treated timber bridges.

LOW BIDDERS

★†**D. C., Wash.**—Pub. Roads Admin., Winder Bldg., 17 and F Sts, N.W., Dec. 11, Bridge 3, War Dpt. Bldg.—road network, from Diamond Constr. Co., 2801 8 St. N.E., **$765,150.** CD 11/26—ENR 12/4.

Louisiana—State Dpt. Hys., Baton Rouge, W. Prescott Foster, dir., Dec. 10, Barataria Bridge, S.P. 826-39-01, Jefferson Parish, from Forcum-James Co., Dyersburg. **$83,753.** CD 11/24—ENR 11/27.

★**New Jersey**—E. D. Sterner, comr. State Hy. Dpt., Trenton, Dec. 12, Beach Thorofare Bridge, approaches, Atlantic Co., from O. Hansen, 7215 Atlantic Ave., Ventnor. **$1,167,013.** CD 11/25—ENR 11/27.

CONTRACTS AWARDED

N. J., Moorestown—Burlington Co., Administration Bldg., Mount Holly, reconstructing Bridge B4.70, Mount Holly, to F. J. Hill, Mount Holly. **$25,000.** Bids 11/7. CD 10/23—ENR 10/30.

N. Y., Little Falls—Bd. P. Wks., City Hall, culvert over Furnace Creek, own forces. **$25,000.** CD 2/13—ENR 2/20.

Tex., Houston—Harris Co., c/o Judge, rein.-con. bridge, Homestead, Berry Gully and Allendale Rds., to O. Peterson, 6608 Capitol St. **$26,545.** H. Zapp, Houston, co. engr.

STREETS AND ROADS

BIDS ASKED

Bids Asked December 23

N. Y., New York—President Bronx Boro, Bronx County Bldg., 851 Grand Concourse, sheet asphalt paving 2 northerly roadways Eastern Blvd., approaches from existing bridge over Bronx River to Bronx River Ave., etc., (7344-G-3); sheet asphalt paving Eastern Blvd., (7344-G-4), etc.

Bids Asked December 30

†**Minn., St. Paul**—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., paving, Post Office and Custom House.

Bids Asked December 31

California—C. H. Purcell, engr. State Hy. Dpt., Sacramento, concrete widening, asphaltic concrete on crusher run paving 1.2 mi. Alameda and Contra Costa Counties.

Louisiana—Dpt. Hys., Baton Rouge, W. Prescott, dir., 4,600 cu. yd. washed gravel (or as alternates 5,410 cu. yd. sand clay gravel or 4,545 cu. yd. washed sand gravel) S.P. 901-00-93, Allen Parish; 5,000 cu. yd. washed gravel (or as alternates, 5,880 cu. yd. sand clay gravel, 4,940 cu. yd. washed gravel), S.P. 901-00-94, East Baton Rouge Parish.

Bids Asked

Mo., Sugar Creek—City, returned unopened all bids to have been opened Dec. 8, paving two 10x10 ft. culverts. $110,000. Robert Schooley & Co., 21 W. 10 St., Kansas City, Mo., engrs. CD 12/1—ENR 11/29.

North Dakota—State Hy. Dpt., Bismarck, cancelled bids to have been opened December 9, imprv. hys. Walsh, Grand Forks, Wells, Dickey, La Moure, Pembina and Traill Counties. CD 11/24—ENR 11/27.

LOW BIDDERS

†**California**—Pub. Roads Admin., Federal Office Bldg., San Francisco, Dec. 9, imprv. 0.454 mi. Sweetwater River Bridge, approaches, San Diego Co., from Contracting Engineers Co., 2310¼ W. Vernon St., Los Angeles, **$98,798.** CD 11/18—ENR 11/27.

Calif., Hawthorne—City, Dec. 8, imprv. Hawthorne Blvd., from V. Kovacevich, 5400 Imperial Hy., South Gate, **$26,129.**

†**Colorado**—Bureau Reclamation, Customhouse, Denver, Dec. 10, relocating State Hy. 9, Green Mt. Dam, Colorado-Big Thompson Project, Spec. 1015, from G. B. Henley, 338 Mesa Verde Dr., Albuquerque, N. M., **$88,420.** CD 11/18—ENR 11/27.

D. C., Wash.—Dist. Comrs., District Bldg., Dec. 9, repairing 2,000 cu.yd. concrete roadway, alley pavement, about 20,000 sq. yd. concrete sidewalks, from J. O. and C. M. Stuart, 4821 Bethesda Ave., Bethesda, Md. **$94,490.**

D. C., Wash.—Dist. Comrs., District Bldg., Dec. 11, repairing asphaltic pavements and concrete bases from McGuire & Rolfe, 1 and O Sts., S.E. **$252,952.** CD 12/9.

★**Florida**—T. A. Johnson, chn. State Road Dpt., Tallahassee, Dec. 11, imprv. 12.6 mi. State Rd. 8-A, Highlands and Glades Counties, from Ebersbach Constr. Co., Stovall Office Bldg., Tampa. **$642,666.** CD 11/25—ENR 11/27.

Kansas—State Hy. Dpt., Troy, Dec. 3, grading 7.165 mi. Doniphan Co., from Geiger & Rutherford, Leavenworth. **$169,601.** CD 11/21—ENR 11/27.

Maryland—State Roads Comn., Baltimore, Dec. 9, imprv. 1.5 mi. Contr. Co. 140-1-250, Caroline Co. from George & Lynch, Dover, Del. **$32,870.** CD 12/1—ENR 12/4.

New Jersey—E. D. Sterner, comr. State Hy. Dpt., Trenton, Dec. 13, imprv. 1.782 mi. Hunterdon Co., from Franklin Contg. Co., 20 Washington Pl., Newark, **$296,966.** CD 11/25—ENR 11/27.

N. Y., Brooklyn—President Brooklyn Boro, Boro Hall, Dec. 15, imprv. 3 Ave. from Mill Basin Asphalt Co., E. 54 St. and Avenue U. **$164,988.** CD 12/8—ENR 12/11.

★**Pennsylvania**—State Hy. Dpt., Harrisburg, Dec. 12, imprv. 13,179 ft. Elk Co., from B. B. Constr. Co., Phillipsburg, **$208,717***** 6,554 ft. Luzerne Co., from H. J. Williams Co., Inc., Sumner St. and W. M. R. R., York, **$405,454***** 13,220 ft. Montgomery Co., from Francis A. Canuso & Son, 804 S. 12 St., Phila., **$412,634***** 6,883 ft. Westmoreland Co., from F. O. Patterson, First St. and Meldon Ave., Donora, **$170,960***** 27,769 ft. Lehigh Co., from C. W. Good, 726 Columbia Ave., Lancaster, **$420,891***** 4,993 ft. Tioga Co., from A. W. Hinaman, Williamsport, **$300,001.** CD 11/11—ENR 11/13.

★**Pennsylvania**—State Hy. Dpt., Harrisburg, Dec. 12, imprv. 36,168 ft. Snyder Co., from F. D. Kessler, Inc., Northumberland, **$913,395;** 43,548 ft. Monroe Co., from Central Pennsylvania Quarry Stripping & Constr. Co., 2700 S. Pine St., Hazelton, **$895,502.** CD 11/11—ENR 11/13.

South Dakota—State Hy. Dpt., H. C. Westphal, secy., Pierre, Dec. 9, imprv. 30.475 mi. Harding Co., from Summit Constr. Co., Rapid City, **$42,963;** 36.401 mi. Harding and Butte Counties, from M. Joyce, Brandon, **$51,258.** CD 11/27.

CONTRACTS AWARDED

Ark., Hot Springs—Paving, curbing, guttering, **WPA. $64,400.** L. R. Plemmons, city engr.

†**Calif., Camp Roberts**—U. S. Eng., Camp Roberts, 87,000 sq. yd. hard standings on drill and parade grounds, to N. M. Ball Sons, P. O. Box 404, Berkeley. **$68,406.**

†**Calif., Camp Roberts**—U. S. Eng., Camp Roberts, 320,700 sq. yd. oil stabilization, light drill areas, grading, to Doudell Constr. Co., P. O. Box 488, San Jose. **$43,368.** Bids 12/8. CD 12/4.

†**Conn., Hartford**—Bd. Contr. & Supply, 550 Main St., 31,500 sq. yd. macadam paving, Docket Conn. 6-164, to Alexander Jarvis Co., Center St., Manchester. **$35,895. DPW.** Bids 12/9. CD 12/5.

★**Ill., East St. Louis**—J. T. Connors, mayor, City Hall, repairs, imprvs. streets, alleys. **WPA. $606,125.**

Ia., Eagle Grove—City, E. J. McGrath, clk., grading, soil cement paving, to J. W. Craig, Esterville. **$30,636.**

La., Leesville—Street imprvts., **WPA. $124,250.**

Mississippi—State Hy. Comn., E. D. Kenna, dir., Jackson, imprv. 11.461 mi. Washington and Bolivar Counties, to Ziegler Constr. Co., American Natl. Bank Bldg., Nashville, Tenn. **$261,283.** Est. $170,000. Bids 12/9, awarded 12/9. CD 11/26—ENR 12/4.

Miss., Yazoo City—Yazoo Co., Yazoo City, imprv. access road to Jackson Air Base, **WPA. $69,555.**

N. J., Garfield—Imprv. streets, removing railroad tracks, grading, 8 in. penetration macadam paving in track area, Harrison Ave. **WPA. $68,354.** C. Malstrom, Orange and N. 6 Sts., Newark, WPA engr.

N. J., Nutley (br. Newark)—Grading, concrete curbing, sidewalks, **WPA. $75,000.** D. Shepherd, town engr.

N. J., Orange—Grading, paving, curb resetting, etc., **WPA. $64,237.** K. Crane, town engr.

N. J., Union City—Grading, asphalt surfacing, drainage, concrete curbing, 5 St. **WPA. $51,194.** C. Malstrom, Orange and N. 6 Sts., Newark, WPA engr.

N. Y., Jamestown—Chautauqua Co. Hy. Dpt., 454 N. Work St., Falconer, town of Ellicott, Community Bldg., Falconer, and city of Jamestown, grading, macadam paving hy. connecting Route 60 with municipal airport (Jamestown), 3 mi. north of here, county forces. **$25,000.** B. Chilson, 454 N. Work St., Falconer, co. supt.

N. Y., White Plains—Reconstructing streets, sidewalks, **WPA. $200,000.**

★**O., Youngstown**—Repaving Glenwood Ave., opening Gibson St., etc., **WPA. $874,000.** R. W. O'Neill, city engr.

Pa., Oil City—C. S. Hetrick, city clk., macadam paving, curbs, gutters, etc., Mitchell Ave., Oak Grove and Carson Sts. own forces. **$25,000.** B. B. Webber, city engr.

Pa., Phila.—Fairmount Park Comn., City Hall, reconstructing River Rd. and east lane

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STREETS, etc. (Contracts Awarded, Cont'd.)

of East River Dr., in Falls of Schuylkill Sect. **WPA. $74,000.**

Pa., Red Lion—Boro Council, D. Hollway, secy., concrete sidewalks, curbs, gutters, storm water sewers, etc., Martin, S. Charles, Fairview, S. Pine Sts., Weaver and Lemon Alleys, **WPA. $50,000.**

Tenn., Linden—R. H. Gray, judge Perry Co., Linden, imprv. roads. **WPA. $152,491.**

Tex., Edna—Jackson Co., farm-to-market roads. **WPA. $71,130.**

Tex., Houston—Harris Co., c/o Judge Pasadena Ferry Rd. work, to Brown & Root, 4300 Calhoun Rd., **$68,000.** W. H. Zapp, Houston, co. engr.

Tex., New Braunfels—Comal Co., c/o County Judge New Braunfels, hardsurfacing 75 mi. roads and imprv. city streets, to Kelly Constr. Co., 2215 Belknap St., San Aontonio. Est. **$200,000.**

Tex., San Antonio—Bexar Co., c/o Judge, 1½ mi. access road between Kelley Field Cadet Reception Center and Holmes Rd., **WPA. $61,-289.** W. Pickard, Court House, co. engr.

Tex., San Antonio—C. K. Quin, mayor, concrete paving 504,432 sq. yd. airport runway, to T. Montgomery, San Angelo, 29c. per sq. yd., total **$146,285.** J. W. Beretta Engineers, Inc., Tower, W. E. Simpson, Milam Bldg., H. R. F. Helland, Frost Bldg., and F. Drought, Frost Bldg., engrs.

†Va., Langley Field—U. S. Eng., constructing Ward Road relocation, to T. E. Ritter Co., Inc., 426 W. York St., Norfolk. **$40,818.** Bids 11/28. CD 11/18.

West Virginia—State Road Comn., Charleston, imprv. 1.397 mi. Hancock Co., to W. A. Wilson & Sons, St. Marys, **$264,744;** 5.174 mi. Wood Co., to Middle States Bit. Corp., Ironton, O. and Boso & Ritchie, Ravenswood, **$271,590.** Bids 12/9. CD 12/1—ENR 12/4.

Contract Awarded

Wis., Peshtigo—Marinette Co., constructing, imprv. roads. **WPA. $120,055.** A. Eklund, Peshtigo, engr.

EARTHWORK WATERWAYS

PROPOSED WORK

★**†Arizona** and **Nevada**—Bureau Reclamation, Custom House, Denver, Colo., bids early 1942, Davis Dam. S. O. Harper, Custom House, Denver, Colo., engr. CD 7/16—ENR 7/24.

†New Jersey—U. S. Eng., 17 Whitehall St., New York, dredging Raritan River, various locations, $1,110,000.

†Wash., Yakima — Bureau Reclamation, Customhouse, Denver, Colo., electric power pump. unit for Snipes Mountain Irrigation Dist.

★**Ont., Niagara Falls**—The Great Lakes-St. Laurence Basin Comn., Ottawa and Washington, bids in 1942, submerged weir, St. Laurence Waterway. $1,000,000.

BIDS ASKED

Bids Asked December 23

†Minnesota—U. S. Eng., P. O. and Customhouse, St. Paul, overflow spillway and discharge channel, Marsh Lake Dam, 25 mi. upstream from Montevideo. CD 10/29—ENR 11/6.

†West Virginia — U. S. Eng., Huntington, Bluestone Dam, appurtenant works, New River, near Hinton. Extended date; adv. ENR 12/18.

B. C., Victoria—Secy. Dpt. P. Wks., Ottawa, Ont., 217 ft. rock dam, Maude Island Passage, at narrowest point between Maude Island and Quadra Island, removing Ripple Rocks Nos. 1 and 2 to grade level of 30 ft. below low water level, Seymour Narrows. $60,000. K. M. Cameron, c/o owner, engr. CD 12/5—ENR 12/11.

Bids Asked January 6

†California—Bureau Reclamation, Old Post Office Bldg., Sacramento, rearing ponds, drainage and water sys., Coleman Station, migratory fish control, Kennett Div., Central Valley Project, about 21 mi. southeast of Redding, Spec. 1021.

Bids Asked January 13

†Texas—U. S. Eng., Galveston, dredging approx. 1,963,000 cu. yd. material from Channel from Galveston Harbor to Texas City; adv. ENR 12/18.

Bids Asked January 15

†Missouri—U. S. Eng., Clock Tower Bldg., Rock Island, Ill., upper approach flow deflecting dike, Pool 22, Mississippi River near Missouri shore below Saverton; adv. ENR 12/18.

Bids Asked January 16

†Miss., Mileston — Farm Security Admin., Donaghey Bldg., Little Rock, Ark., 20 mi. drainage ditches, culverts, flood gates, concrete headwalls, raising levee, etc.

Bids Asked February 3

†Canal Zone—The Panama Canal, 135 K St. N.W., Wash., D. C., gates, valves, [illegible] for third locks, Panama Canal, Sch[illegible]

LOW BIDDERS

Calif., Los Angeles—Los Angeles County Flood Control Dist., 751 S. Figueroa St., Dec. 9, debris basin, Aliso Creek, Wilbur [illegible] from Dimmitt & Taylor, 815 E. 9 St., $31,637. H. E. Hedger, 751 S. Figueroa St., engr.

★**†Louisiana**—U. S. Eng., foot of Prytania St., New Orleans, Dec. 8, fdn. and masonry for Bayou Sorrel Lock, East Atchafalaya Basin Protection Levee on Plaquemine-Morgan City Route, Intracoastal Waterway, Iberville Parish, 15 mi. southwest Plaquemine, to Austin Bridge Co., 1813 Clarence St., Dallas, Tex. **$700,179.** CD 11/12—ENR 11/20.

†Missouri—U. S. Eng., Little Rock, Ark., clearing 512 acres, Clearwater Dam site, Inv. 777-42-38, from R. Langston, Springfield, **$20,-224.** Est. $25,202. CD 11/17—ENR 11/20.

N. J., Long Branch—State Bd. Commerce and Navigation, State House, Trenton, Dec. 12, coast protection structures, appurtenances, Atlantic Ocean shorefront, from Thomas Proctor Co., Inc., 218 N. 5 Ave., **$224,156.** Est. $188,000. CD 12/1—ENR 12/4.

N. C., Worthville — Leward Cotton Mills, Inc., office of manager, Worthville, Dec. 4, dam imprvs., from F. D. Lewis & Son, Greensboro. Est. over **$15,000.** CD 12/2.

CONTRACTS AWARDED

†California—Bureau Reclamation, Customhouse, Denver, Colo., 2 wheel gates for tunnel, Shasta Dam, Central Valley Project, Spec. 1009, to American Bridge Co., 1st Natl. Bank Bldg., Denver, Colo., **$56,593;** 2 hydraulic hoists for gates, to Willamette Iron & Steel Corp., 2860 N.W., Front St., Portland, Ore., **$93,072.** Bids 11/18. CD 10/27—ENR 10/30.

Fla., Jacksonville—Dredging 90,000 cu. yd. material from waters, municipal docks, Tallerand Ave., to Jacksonville Utility Co., Municipal Docks, **$30,000.** Awarded 12/5. W. E. Sheddan, Jacksonville, city engr.

†Illinois—U. S. Eng., P. O. Box 59, Louisville, Ky., flood protection works, Cache River Diversion, Unit 1, Mound City, to Stiers Bros. Constr. Co., 2944 Magazine St., St. Louis, Mo. **$543,089.** Bids 11/14. CD 11/19—ENR 11/27.

†Nebraska—U. S. Eng., 1709 Jackson St., Omaha, constructing nose protection structure at head of proposed pilot canal, Missouri River, Omadi Bend, **$27,000;** excavating 185,-000 cu. yd. earth from channel Missouri River to form pilot canal at Omadi Bend, **$18,800,** both in Homer; nose protection structure at head pilot canal, Missouri River at Bowers Bend, Winnebago, **$18,500;** constructing 670 ft. standard revetment in Missouri River at Civil Bend, Nebraska City, **$16,000.** Purchase and Hire. Grand total $80,300. CD 9/25, 9/10 and 12/9—ENR 9/18 and 12/11.

N. J., Newark—Essex Co. Park Comn., 115 Clifton Ave., flood control, various parks, **WPA. $38,500.** R. D. Crater, 115 Clifton Ave., co. engr.

O., Conneaut—Bessemer & Lake Erie R. R. Co., F. R. Layng, ch. engr., Greenville, Pa., enlarging vessel winding basin, Conneaut Harbor, Lake Erie, incl. cutting back winding area 22 ft., etc., to Great Lakes Dredge & Dock Co., Williamson Bldg., Cleveland, O. Est. **$250,000.**

UNCLASSIFIED

PROPOSED WORK

★**Ala., Birmingham**—MINE EXPANSION—Republic Steel Corp., Empire Bldg., mine expansion, Spaulding Ore mine. $3,000,000.

Ariz., Safford—AIRPORT—U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., indefinitely postponed bids to have been opened December 9, airport, incl. clearing, grading, paving, drainage. CAA. CD 12/2.

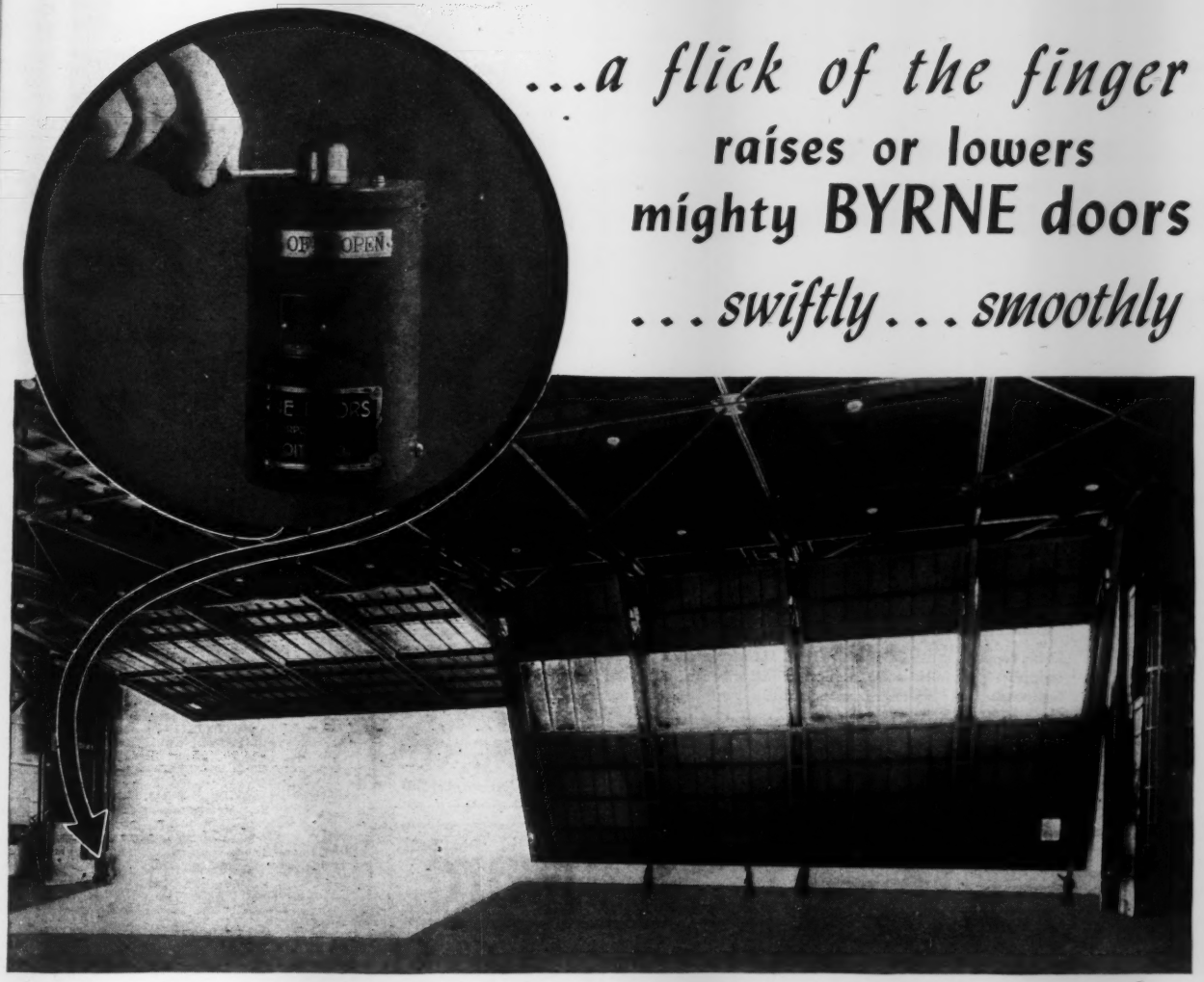
★**Ark., Hot Springs** — AIRPORT — L. McLaughlin, mayor, airport, at or near here. $1,000,000. CAA.

Calif., Huntington Beach — AIRPORT — Imprv. airport. $63,731. H. Overmyer, City Hall, engr.

Calif., Lone Pine and **Independence**—AIRPORT GRADING, etc.—U. S. Eng., 751 S. Figueroa St., Los Angeles, indefinitely postponed bids to have been opened Dec. 15, airport, clearing, grading, Lone Pine-Independence airport. CD 11/27—ENR 12/4.

★**Georgia**—TRANSMISSION LINE, etc.—Georgia Rural Power Reserve Electric Membership Corp., Louisville, 756 mi. 44 kv. transmission line, and 3 steam generating plants. $3,750,000 REA allot.

Kan., Arkansas City and **Winfield**—AIRPORT IMPROVEMENTS—Cities, bids during December grading and bids after Jan. 1, for hangar. $214,000. CAA. CD 4/15—ENR 4/17.



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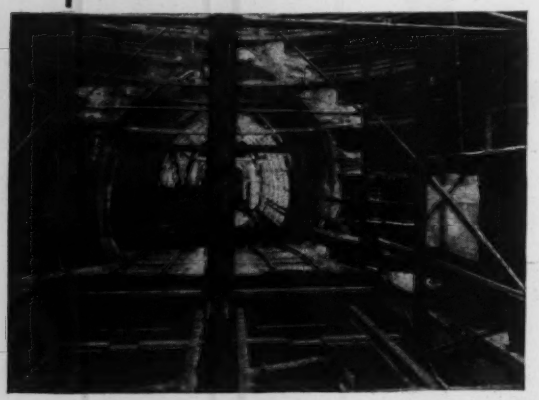

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UNCLASSIFIED (Proposed Work—Contd.)

Kan., Topeka—AIRPORT IMPROVEMENT—Imprv. airport. Over $100,000. CAA.

★**Louisiana and Mississippi**—OIL PIPELINE—Carter Oil Co., 30 Rockefeller Plaza, New York, N. Y., 200 mi. crude oil pipeline from Baton Rouge, La. to Jackson, Miss., incl. pump. stations. $1,500,000.

La., Morgan City—PIPELINE, etc.—Voted bonds pipeline and gas transmission system, $164,000. T. B. Smith, Houma, engr. CD 2/6.—ENR 2/6.

Mass., Newton (br. Boston)—GRANDSTAND, etc.—A. Campbell, supt. City Buildings Dpt., City Hall, concrete, steel grandstand and hockey rink, High School Athletic field. $50,000.

Mass., Springfield — GRANDSTANDS — Park Dpt., Forest Park, Springfield, bids in spring, steel concrete, Walker Memorial Grandstand, Forest Park, $50,000, CD 5/2—ENR 5/8; Park Dpt., R. C. Chapin, chn., City Hall, concrete steel enclosed athletic field with 2 grandstands, $35,000.

Mich., Pt. Huron—ATHLETIC FIELD—Bd. Educ., H. D. Crull, supt., Port Huron, athletic field, River St. $30,000-$35,000.

★**Mo., St. Louis**—TRACKS, etc.—St. Louis-San Francisco Ry. Co., F. G. Jonah, chief engr., Frisco Bldg., 9 and Olive Sts., replacements, imprvs. roadbeds, new trackage, etc., various parts system. $2,478,[illegible].

Mont., Bozeman—RUNWAYS—Paving 2 runways, taxiways, lighting, Bozeman Airport, near Belgrad. $250,000. CAA. CD 10/27—ENR 10/30.

Neb., Nebraska [illegible]—PARK—Ethel Gaskill, city clk., park and recreational improvements, $50,000.

★**N. J., Newark**—MARINE TRANSIT SHED, etc. — Imprv., Manufacturing Port Newark, 250x750 ft. marine transit shed, 2,077 ft. dock, demolition old work wharf and pier, and reconstructing 2,400 ft. wharf and 700 ft. pier, etc. $2,578,925. WPA. J. Costello, city engr.

New York—NATURAL GAS DEVELOPMENT—Empire Gas & Fuel Co., Ltd., Wellsville, developing deep-sand natural gas properties, connecting pipelines, booster stations, drilling wells, Allegany and Steuben Counties. Over $50,000.

★**N. Y., North Beach**—LOADING PLATFORM ADDITIONS, etc.—Dpt. Docks, Park A, North River, New York, loading platform addns., $40,000; sheet pile bulkhead wall along westerly and northerly sides airport, $500,000; land plane hangar, $1,450,000, all foregoing Municipal Airport 2, La Guardia Field.

★†**N. Y., Syracuse**—BOMBARDMENT AIR BASE—U. S. Eng., 1 and Douglas Sts., N.W. Wash., D. C., bombardment air base, $7,500,000.

North Carolina—RURAL ELECTRIC LINES—Davie Electric Membership Co-operative, Mocksville, Davie Co., 229 mi. rural electric lines, Davie Co. $235,000 allot.

North Carolina—RURAL ELECTRIC LINES—Piedmont Electric Membership Co-operative, Hillsboro, 143 mi. rural electric lines, Orange Co. $170,000 allot. CD 6/3—ENR 6/

North Carolina—RURAL ELECTRIC LINES—Roanoke Electric Membership Co-operative, Halifax, 223 mi. rural electric lines. $300,000 allot.

★†**O., Columbus** — BOMBARDMENT AIR BASE — U. S. Eng., 1 and Douglas Sts., N.W., Wash., D. C., bombardment air base, $7,500,000.

★**Okla., Tulsa**—AIRPORT, etc.—Voted bonds purchasing site and imprvs. for auxiliary airport, $50,000, purchasing property and imprvs. for extend. runways, municipal airport, $100,000; 9 distr. sys. imprvs. $524,775. W. R. Wooten, City Hall, engr. CD 11/13—ENR 11/20.

Pennsylvania and New York — OIL DEVELOPMENT—Messer Oil Co., Olean, N. Y., oil development, wells, gathering and connecting lines, steel tank storage facilities, etc., Allegany field, southern New York state, and Bradford Field, McKean Co., Pa. $50,000-$60,000.

★†**S. C., Greenville**—BOMBARDMENT AIR BASE—U. S. Eng., 1 and Douglas Sts., N.W., Wash., D. C., bombardment air base, $7,500,000.

S. D., Pierre—AIRPORT—N. W. May, city clk., airport. $290,000. CAA.

★†**S. D., Rapid City**—BOMBARDMENT AIR BASE—U. S. Eng., 1 and Douglas Sts., N.W., Wash., D. C., bombardment air base, $7,500,000.

Tenn., Chattanooga—AIRPORT—E. D. Bass, mayor, imprv. addn. to Lovell Field. $30,000.

★†**Tenn., Nashville**—BOMBARDMENT AIR BASE—U. S. Eng., 1 and Douglas Sts., N.W., Wash., D. C., bombardment air base, $7,500,000. CD 10/20—ENR 10/23.

Texas—GAS PIPELINE—Lone Star Gas Co., 1915 Wood St., Dallas, 28 mi. natural gas pipeline north from Athens to tie in with Opelika-Trinidad Carrier. $65,000.

★**Tex., Beaumont** — AIRPORT — Airport facilities. $543,000.

UNCLASSIFIED (Proposed Work, Cont'd.)

Tex., Dryden—AIRPORT—Airport, facilities. $466,000.

★**Tex., Houston** — SHIPBUILDING — San Jacinto Shipbuilding Co., Houston, concrete barge building plant, on channel toward Galveston. $3,285,000.

Tex., Lufkin—AIRPORT—Airport, facilities. $428,000.

Tex., Nacogdoches—STADIUM, etc.,—Stephen F. Austin College, Nacogdoches, recreational plant, incl. football stadium, concrete swimming pool, cinder track, athletic courts, etc. $130,000.

★**†Tex., San Antonio**—HANGARS—U. S. Eng., Federal Bldg., Galveston, completed plans and bids soon 3 additional airplane hangars, Kelly Field. $585,000. CD 6/17—ENR 6/19.

Tex., Sanderson—AIRPORT—Owner, c/o City, airport and facilities. $431,000.

Tex., Temple — AIRPORT — Voted $35,000 bonds, airport imprvs. $370,000. CAA. CD 12/1—ENR 8/28.

Tex., Van Horn—AIRPORT—Airport, facilities. $463,000.

Tex., Wichita Falls—OIL PROPERTIES EXPANSION—Pan Oil Co., Harvey-Snider Bldg., imprv., expanding oil producing facilities.

Tex., Wink—AIRPORT—Airport facilities. $364,000.

Utah, Cedar City—AIRPORT—U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif. indefinitely postponed bids to have been opened Dec. 8, clearing, grading, paving, appurtenant work, airport. CAA. CD 12/2.

Utah, Salt Lake City—AIRPORT BUILDINGS—U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., indefinitely postponed bids to have been opened Dec. 9, temporary bldgs., altering warehouse, Salt Lake Airport. CD 11/27.

★**†Va., Richmond** — BOMBARDMENT AIR BASE—U. S. Eng., 1 and Douglas Sts. N.W., Wash., D. C., bombardment air base. $7,500,000.

†Wash., Spokane—RUNWAYS—U. S. Eng., Central Bldg., Seattle, cancelled bids to have been opened Dec. 10, imprv. runways, Felts Field, inv. 869-42-205. $120,000. Will readvertise. CD 12/2.

★**†Wash., Walla Walla** — BOMBARDMENT AIR BASE—U. S. Eng., 1 and Douglas Sts. N.W., Wash., D. C., bombardment air base. $7,500,000.

Wisconsin—RURAL ELECTRIC LINES—Dunn County Electric Co-operative, M. B. Rotnem, supt., Menomonie, 46 mi. rural electric lines, Dunn, Chippewa and Pepin Counties. $40,000 REA allot.

Wis., Kewaunee—SHIPYARD BUILDING—Kewaunee Shipbuilding & Eng. Corp., Kewaunee, 1-story, 80x192 ft., frame, steel shipyard bldg. G. Feldhausen & G. Coughlen, Columbus Bldg., Green Bay, archts.

Wis., Superior—SHIPWAYS, etc.—Lake Superior Shipbuilding Co., Superior, 5 shipways, fabricating shop, crane equip.

Quebec—RAILROAD EXTENSION — Canadian Pacific Ry. Co., Windsor Station, Montreal, J. E. Armstrong, ch. engr., railroad exten. to Range St. Mathieu, Lac a-la Tortue, $70,000.

Que., Grand Mere — RAILROAD EXTENSION—Canadian National Rys., 360 McGill St., Montreal, H. A. Dixon, ch. engr., railroad exten. to St. Maurice River bridge. $50,000.

BIDS ASKED

Bids Asked December 29

†Tex., Lubbock—AIRPORT—U. S. Eng., Caddoa, Colo., 120x160 ft. Air Corp engineering shop bldg., 20x20 ft. oil storage bldg., etc. $120,000. CD 12/8—ENR 12/11.

Bids Asked December 30

†Ore., The Dalles—PIERS, etc.—U. S. Eng., Pittock Blk., Portland, concrete piers, floating wood and timber fender, upper entrance The Dalles-Celilo Canal, Inv. 351.

Bids Asked About January 2

Ga., Bainbridge — AIRPORT IMPROVEMENTS—U. S. Eng., Federal Bldg., Mobile, Ala., clearing, grubbing, earthwork, preparation subgrade, paving, spillways, storm sewers, etc., CAA airport.

Bids Asked About January 5

†N. M., Roswell—AIRFIELD—U. S. Eng., Caddoa, Colo., airfield incl. sewage disposal plant, incinerator.

Bids Asked January 7

†Md., Aberdeen Proving Ground—HANGAR, etc.—U. S. Eng., 332 Post Office Bldg., Baltimore, A. C. hangar, control tower, boiler house, Aberdeen Proving Ground Airfield.

LOW BIDDERS

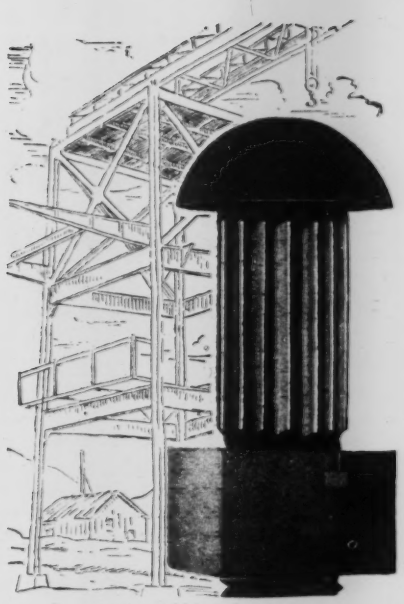
Colorado — RURAL ELECTRIC LINES — Highline Electric Assn., Holyoke, Nov. 28, 430 mi. rural electric lines, from Snyder & Johnson, Inc., Humboldt, Ia., **$278,731.** Est. $300,000. CD 11/17—ENR 11/20.

"Structural Rib Bolts"

(Trade mark Registered)

Manganese Steel

Galvanized and Black



The only ribbed bolt on the market that has American Standard Threads and the Automatic Lock Nut. The lock nut that complies with Federal Specification FFB-571a—used for plain bolting.

"Structural Rib Bolts," equipped with "Automatic Lock Nuts," have been approved in place of field driven rivets, not only on Federal Projects, but in practically every state and several foreign countries.

Structural Rib Bolts comply with Federal Specifications QQ-S-721a and are being used very extensively in the construction of **Defense Projects such as Ordnance Plants—Radio Towers—Hangers—Warehouses, etc.**

The following advantages of "Structural Rib Bolts" are endorsed by engineers:

1. Made from Manganese Class A Steel—guaranteed to develop more than 70,000 lbs. tensile. Tests show a 5/8" dia. bolt to be stronger than a 3/4" dia. rivet.

2. The Automatic Lock Nut is a one-piece unit, no extra parts, *really locks*—U.S. Standard threads and millions now in use on Standard Machine Bolts.

3. The ribs mush and fill the hole making a body-bound fit—The "Structural Rib Bolt" and "Automatic Lock Nut" *can be GALVANIZED* if necessary.

4. Made for every thickness of work or grip in any diameter from 1/4" to 2" inclusive.

Send direct to plant for sample "Structural Rib Bolt" and Engineering Data—no obligation.

We make shipment of large quantities from our plant at Lebanon, Pa. —Small quantities for quick deliveries from one of our warehouses.

AUTOMATIC NUT COMPANY, INC.

LEBANON, PENNSYLVANIA

HERE'S JUST WHAT CALCIUM CHLORIDE DOES FOR

COLD WEATHER CONCRETE!

1—REDUCES COST—Cuts delays between operations . . . saves on fuel, heaters and canvas . . . permits quicker finishing and earlier release of forms.

2—CUTS SETTING TIME—National Bureau of Standards tests show actual time of initial and final set are reduced ⅔ when calcium chloride is used.

3—PRODUCES HIGH EARLY STRENGTH—For example, calcium chloride increases one day strength of 40 degree concrete by 300% as compared to same concrete without calcium chloride . . . increases 3 day strength 117%, 7 day strength 75%.

4—INCREASES FINAL STRENGTH—National Bureau of Standards and P. C. A. tests show calcium chloride increases ultimate strength from 7 to 12%.

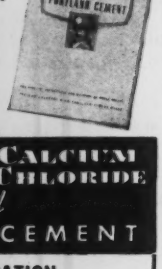
5—ADDS EXTRA PROTECTION—Solvay Calcium Chloride in the mix gives *extra* protection against frozen concrete by speeding set and increasing early strength!

6—PROVIDES DEPENDABLE CURING—Assures positive, uniform curing in all concrete, including paving, structural and products.

7—SHORTENS PROTECTION PERIOD—by speeding set and increasing early strength, Solvay Calcium Chloride cuts winter protection period in half . . . shortens danger period.

8—PERMITS LESS FORMS—Earlier release of forms permits quick reuse . . . fewer needed.

9—INCREASES DENSITY AND HARDNESS—Solvay Calcium Chloride permits reduction of water-cement ratio . . . means fewer water voids, denser, more moisture-resistant concrete.



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UNCLASSIFIED (Low Bidders, Cont'd.)

★**†Md., Sparrows Point (Br. Baltimore)**—SHIPBUILDING PLANT—Bethlehem Steel Co., E. 3 St., Bethlehem, Pa., Nov. 28, shipbuilding plant addns., 15 miscellaneous bldgs., shops, locker bldgs., warehouses, office bldg., railroad siding, from Irwin & Leighton, 1505 Race St., Phila., Pa. **$750,000** plus. CD 11/25.

Miss., Pascagoula—AIRPORT—U. S. Eng., Federal Bldg., Mobile, Ala., Dec. 1, airport, for Bd. Supervs. Jackson Co., from R. H. Wright, Macon Rd., Columbus, Ga. **$300,000.** Est. $232,000. CAA. CD 11/12—ENR 11/20.

★**†Tex., Waco**—AIRPOST—U. S. Eng., Federal Bldg., Galveston, Dec. 9, airpost, from J. W. Bateson, Fort Sill, Okla., **$1,856,580.** CD 11/21—ENR 11/27.

†Washington — TRANSMISSION LINE — Bonneville Power Admin., P. O. Box 3537, Portland, Ore., Dec. 4, Midway-Coulee section Bonneville-Coulee Transmission Lines 2, Inv. 2403, from American Bridge Co., Frick Bldg., Pittsburgh, Pa. **$391,848.** CD 11/18—ENR 11/27.

†Alaska, Yakutat—GASOLINE FUELING SYSTEM—U. S. Eng., Central Bldg., Seattle, Wash., Dec. 8, Air Corps, fueling sys., from Aqua Systems, Inc., 385 Gerard Ave., New York, N. Y. **$249,900.** Est. $119,413. CD 11/24—ENR 11/27.

CONTRACTS AWARDED

†Calif., Long Beach—ELECTRICAL DISTRIBUTION SYSTEM—U. S. Eng., 751 S. Figueroa St., Los Angeles, electrical distr. sys., etc., Long Beach Ferrying Command, to Newery Electric Corp., 1038 Venice Bl., Los Angeles, **$26,124.**

†Calif., McClellan Field—AIR DEPOT IMPROVEMENTS—U. S. Eng., Sacramento, additional sewer, gas and water utilities, to A. Teichert & Son, Inc., 1846 37 St., Sacramento, **$97,688,** cost plus basis.

†Calif., Moffet Field—RUNWAYS, etc.—U. S. Eng., Sacramento, supplemental contract, runways, taxiways, to M. S. Hanrahan, P. O. Box 429, Redwood City, **$102,466.** Additional to CD 7/2—ENR 7/10, under L/B.

Calif., Redwood City—SILOS—Permanente Materials Corp., Los Altos, six 72 ft. silos set on piling, pipelines to docks, pump and unloading houses, port, Redwood City, own forces. CD 12/2—ENR 12/4.

Fla., Bartow—AIRPORT — Clearing, grubbing, imprv. airport. **WPA. $215,550. CAA.**

Ga., Brunswick—RUNWAY—U. S. Eng., 1 and Douglas Sts. N.W., surfacing, widening, exten. runways, installing electric units and drain pipe, Glynn County Airport, (St. Simon Island) to Breslin Constr. Co., Inc., Midwest Bldg., Louisville, Ky., **$134,165.** Bids 11/19. CD 11/13.

Ga., Marietta—AIRPORT—U. S. Eng., Mobile, Ala., landing strips, runways, taxiways, Cobb County Airport, near here, to W. L. Florence Constr. Co., Powder Springs. **$159,082.**

†Mass., Bedford—AIRPORT IMPROVEMENTS—U. S. Eng., Park Sq. Bldg., Boston, exten. runways, paving, exten. base lighting sys., etc., to M. De Matteo Constr. Co., Inc., 71 Blue Hills Pkway., Milton. **$282,380.** Awarded 12/4.

N. J., Camden—PARK IMPROVEMENTS—Camden Co. Park Comn., Court House, imprv. Harleigh Park. **WPA. $109,623.** G. R. Swinton, 930 Atlantic Ave., Atlantic City, WPA and owner's engr. CD 10/29—ENR 11/6.

†N. J., Fort Dix—RUNWAY, etc.—U. S. Eng., imprv. Runway 2, excavating, grading, draining, exten. runway from 2,900 to 5,280 ft. by 20 ft., **WPA. $210,000.**

N. J., Newark — SHIPBUILDING — Port Newark Shipbuilding Corp., 17 Battery Pl., New York, N. Y., shipbuilding facilities, 1 story, 300x350 ft. mould loft, two 100x300 ft. frame office bldgs., etc., 75 x 140 ft. storage, 1 story, 75x75 ft. power plant, to Clifford F. MacEvoy Constr. Co., 140 Roseville Ave., **$125,000.**

N. J., Nutley (br. Newark)—PARK IMPROVEMENTS—Imprv. Booth, Nichols, Reinheimer and Kingsland Parks, **WPA. $119,000.** D. Shepherd, town engr.

N. C., Kingston—AIRPORT—Town, W. F. Stanley, mayor, and Lenoir Co., H. Worthington, chn. Bd. Comrs., airport, two 2,500 ft. runways, **WPA. $101,321.** CD 6/23—ENR 7/3.

★**N. C., Raleigh-Durham** — AIRPORT — Raleigh-Durham Airport, Raleigh and Durham (sponsors cities of Raleigh and Durham, Wake and Durham Counties), airport. **WPA. $706,454.** CD 1/22—ENR 1/20.

Pa., Pen Argyl—STREET LIGHTING SYSTEM—Metropolitan Edison Co., 412 Wash. St., Reading, street lighting sys., own forces. **$25,000-$35,000.** CD 12/5—ENR 12/11.

Pa., Warren—HANGAR—Boro Council, M. L. Dougherty, boro secy., concrete, steel, block hangar addn., airport, own forces. **$25,000.** C. Barwis, boro engr.

Pa., Wilkes-Barre—TRACK REMOVAL, etc.—Wilkes-Barre Railway Corp., 300 Market St., and Boro Councils of Sugar Notch, Warrior Run and Ashley, also Supervs. Hanover Twp., removing abandoned trolley tracks, various streets, repaving afterwards, **WPA. $50,000.** CD 1/10—ENR 12/11.

†Tex., Amarillo—AIR NAVIGATION FACILITIES—U. S. Eng., Caddo, Colo., supplemental contract additional air navigation facilities, English Field, to Lee Moore Const. Co., 204 Bassett Tower, El Paso, $144,444. Additional to CD 6/9—ENR 6/12, under CA.

Tex., Houston—FERRY—Harris Co., Judge, Pasadena ferry concrete and heavy timber slips, to H. Cagle, 2410 McIlhenne St., **$32,199.** W. H. Zapp, co. engr.

Tex., Tyler—AIRPORT IMPROVEMENTS—U. S. Eng., Citizens Bank Bldg., Dallas, airport imprvs., clearing, grubbing, grading, drainage, etc. **WPA. $60,000.** CAA. Bids 11/20. CD 10/28—ENR 10/30.

Tex., Waco—AIRPORT—U. S. Eng., Federal Bldg., Galveston, supplemental contract, grading, drainage, landing strips, runways, paving, etc., airport, to L. P. Reed, Meridian, **$136,693.** CAA. Additional to CD 6/6—ENR 6/12 under CA.

Wis., Milwaukee—SHIPBUILDING PLANT—Froemming Bros. Co., Inc., 1901 S. 1 St., 1 story, 101x180 ft., steel ship bldg. plant, concrete fdn., to Hunzinger Constr. Co., Sta. K; steel, to C. Hennecke Co., 3225 W. Pierce St. W. Grierson, 219 E. Wright St., engr.

★**B. C., Vernon**—HYDRO DEVELOPMENT—Province of British Columbia, Victoria, B. C., (West Canadian Hydro Corp., 744 W. Hastings St., Vancouver), developing power, incl. 60,000 volt high tension line from Shuswap Falls to here, to Hume & Ramble, 314 Water St., Vancouver, approx. **$300,000;** storage dam at Sugar Lake, day labor. Total est. $650,000.

Man., Winnipeg—AIRPORT, etc.—Trans-Canada Airlines, Ltd., McGill St., Montreal, Que., exten. airport and repair shop, to Bird Constr. Co., Confederation Bldg., **$120,000.**

N. S., Dartmouth—HANGAR—Dpt. National Defense for Air, Ottawa, Ont., seaplane hangar, for R.C.A.F., to Stewart Constr. Co., Ltd., 7 Dufferni Ave., Sherbrooke, Que., **$225,000.** Bids 11/25.

★**N. S., Westmount**—SHIPYARD—Dpt. National Defense for Sea, Ottawa, Ont., shipyard, incl. 22 bldgs., workshops, machine shops, dwellings, etc., to Dominion Constr. Co. Ltd., Westmount, **$1,600,000.**

★**Quebec**—TRANSMISSION LINES—Shawinigan Water & Power Co. 107 Craig St. W., Montreal, steel work for transmission lines between Three Rivers and Berthier and Sorel and Hemmings Falls, to Canadian Bridge Co. Ltd. 620 Cathcart St., Montreal. Total est. **$1,600,000.** CD 12/11.

Que., Cap de la Madeleine—HANGAR—Canadian Airways Ltd., Airway Bldg., Winnipeg, Man., hangar, to Page Equipment & Constr. Co. Ltd., 1497 Craig St., Three Rivers, **$62,900.** E. J. Turcotte, 1010 Ste. Catherine St. W., Montreal, archt. CD 11/17—ENR 11/20.

Que., St. Jean—HANGAR—Dominion Govt., Ottawa, Ont., 162x225 ft., hangar, to Consolidated Constr. Co. Ltd., 10 St. James St. E., Montreal, **$90,000.** CD 11/24.

LATIN AMERICA

El Salvador, San Salvador—Central Govt. of El Salvador, taking bids constructing water supply sys., $500,000; completion Pan-American Hy. across El Salvador, incl. grading, embankment, draining, paving, bridge, etc. $1,500,000.

Mexico—Dpt. Bldgs. & Communications, **Mexico City,** bids soon constructing concrete, steel bridges, grading, leveling, embankments, draining, cuts, rock walls, paving, etc. Pan-American and Nogales-Mexico City Hys., $30,000,000, Dpt. Federal Engineers, Mexico City, engrs. *** **Pemex, Mexican** Petroleum Admin., c/o E. Buenrostro, Mexico City, plans facilities for repairing, servicing oil tankers, boats, etc., in **Tampico,** $1,000,000***imprv., expanding oil refineries in **Pozarica** Zone $3,500,000, in **Tampico** areas, $3,500,000*** Republic of Mexico, **Mexico City,** plans dams, to make more land available for needed crops, $1,000,000, Dpt. P. Wks., Mexico City, engr.

South America, Argentina—Republic of Argentina, Buenos Aires, taking bids underground ammunition and equip. storage facilities, barracks, protective steel, concrete bulwarks, and gun emplacements, harbor and shipping facilities, etc., Strait of Magellan.

South America, Chile—Republic of Chile, **Santiago,** plans cement factory, south of Chile, $750,000, also shipbuilding yard, initial cost **$500,000,** in Valparaiso, Dpt. P. Wks., Santiago, engrs.***Central Government of Chili, taking bids constructing rein.-con., steel armament emplacements, protective armament bulwarks, barracks, underground ammunition and equip, storage facilities, etc., Strait of Magellan. **Santiago.**

South America, French Guiana, Cayenne—Republic of France, Vichy, France, voted 48,000,000 francs for wharfs, etc., about $960,000; also 10,000,000 francs for administration bldgs., about $240,000. Dpt. P. Wks., Cayenne, Guiana, engrs.

PUBLIC BUILDINGS

PROPOSED WORK

†**Ark., Fort Smith**—City, plans by E. Chester Nelson, Merchants Bank Bldg., health center, Docket Ark. 3-122. $50,000. **DPW.** CD 11/14—ENR 11/20.

†**Calif., Santa Ana**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D.C., bids soon 2 story administration bldg., 8 and Shelton Sts., for Ninth Army Air Corps. Training Center.

†**Conn., Bridgeport**—Jenkins Bros., 510 Main St., 5 story, brick, steel factory for Navy Dpt. Defense Plant Corp. will finance.

†**Fla., Panama City**—Bd. Pub. Instruction of Bay County, acting in behalf Parker Special Tax School Dist., plans by Reynolds, Brewton, Smith & Hills, Duval Bldg., Jacksonville, Parker School addn., near here, Docket Fla. 8-168. $48,000. **DPW.** CD 11/7—ENR 11/13.

†**Ill., Monsanto**—Monsanto Chemical Co., 1700 S. 2 St., St. Louis, Mo., bids soon 2 story, 70x80 ft., brick, rein.-con. chemical plant addn., for War Dpt. $310,200. W. J. Knight & Co., Wainwright Bldg., St. Louis, Mo., engrs.

†**Ky., Hopkinsville**—Bd. Health Christian Co., health center, Docket Ky. 15-142. $40,000. **DPW.**

†**Ky., Louisville**—City, health center, Docket Ky. 15-125. $164,350. **DPW.**

†**Ky., Newport**—Campbell Co., Alexandria, health center, Docket Ky. 15-107. $69,200. **DPW.**

†**La., Alexandria**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-167. $116,000. **DPW.** CD 10/28—ENR 10/30.

†**La., Baton Rouge**—U. S. Housing Auth., Interior Bldg. (North) 18 and F Sts. N.W., Wash., D. C., 40 defense housing units.

†**La., Bossier**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-188. $6,960. **DPW.** CD 10/28—ENR 10/30, under Benton.

†**La., Bunkie**—State Bd. Health, Baton Rouge, plans by A. Hayes Town Baton Rouge, health center, Docket La. 16-180. $5,800. **DPW.**

†**La., Colfax**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-179. $5,800. **DPW.** CD 10/28—ENR 10/30.

†**La., Crowley**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, health center, Docket La. 16-172. $17,400. **DPW.** CD 10/28—ENR 10/30.

†**La., De Ridder**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-169. $34,800. **DPW.** CD 10/28—ENR 10/30.

†**La., Glenmora**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-177. $5,800. **DPW.** CD 10/28—ENR 10/20.

†**La., Jena**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-182. $5,800. **DPW.** CD 10/28—ENR 10/30.

†**La., Lafayette**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-171. $34,800. **DPW.** CD 10/28—ENR 10/30.

†**La., Lake Charles**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-170. $34,800. **DPW.** CD 10/28—ENR 10/30.

†**La., Le Compte**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-178. $5,800. **DPW.** CD 10/28—ENR 10/30.

†**La., Leesville**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-187. **DPW.**

†**La., Marksville**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-175. $8,700. **DPW.** CD 10/28—ENR 10/30.

†**La., Minden**—Div. Defense Housing, 811 Vermont Ave., N.W., Wash., D. C., 200 defense housing units.

†**La., Natchitoches**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-173. $17,400. **DPW.** CD 10/28—ENR 10/30.

†**La., Oakdale**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-181. $5,800. **DPW.** CD 10/28—ENR 10/30.

†**La., Ville Platte**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-176. $8,700. **DPW.** CD 10/28—ENR 10/30.

†**La., Winnfield**—State Bd. Health, Baton Rouge, plans by A. Hayes Town, Baton Rouge, health center, Docket La. 16-174. $8,700. **DPW.** CD 10/28—ENR 10/30.

†**Me., Portland**—Maine General Hospital, plans by Coolidge, Shepley, Bulfinch & Abbott, 1 Court St., Boston, Mass., alteration, imprvs., addns., Maine General Hospital, Docket Me. 17-131. $224,875. **DPW.** CD 12/3—ENR 12/11.

†**Md., Baltimore**—Bendix Aviation Corp., 30 Rockefeller Plaza, New York, N. Y., bids first of year manufacturing bldg. for Navy Dpt. $230,000 land and bldgs., $150,000 equip. Defense Plant Corp. will finance. CD 11/10—ENR 11/13.

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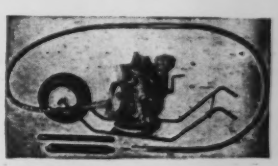

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PUBLIC BLDGS. (Proposed Work, Cont'd.)

†**Mass., Pittsfield** — Div. Defense Housing FWA, 811 Vermont Ave. N.W., Wash., D. C., plans by F. L. Wright, Spring Green, Wis., 100 defense housing units, Project 19061X. $375,000. CD 11/12—ENR 11/20.

Mich., Detroit—State, Lansing, plans by Smith, Hinchman & Grylls, archts. and engrs. 800 Marquette Bldg., rebuilding, enlarging, brick, steel, rein.-con. armory. $309,000.

★†**Mich., Grand Rapids**—Extruded Metals, Inc., Belding, plans by H. D. Ilgenfritz, 468 Prentis Ave., Detroit, brick, steel, rein.-con. plane plant, plain fdn., for War Dpt. $6,615,000 incl. equip. Defense Plant Corp. will finance. CD 10/14—ENR 10/16.

†**Mich., Lansign**—Edward W. Sparrow Hospital Assn., 1215 E. Michigan Ave., plans by Bowd-Munson, 400 Wilson Bldg., Lansing, brick, steel, stone, rein.-con. hospital, plain fdn., Docket Mich. 20-114, $350,000. **DPW.** CD 11/18—ENR 11/27.

†**Miss., Hattiesburg** — City, Junior High School, 2 schools one for negroes, one for whites, 7 school addns., etc., Docket Miss. 22-120. $483,600. **DPW.**

★**Miss., Pascagoula**—Bd. Supervs. Jackson Co., Pascagoula, plans by C. L. Olschner, Carondolet Bldg., New Orleans, La., 4 story, bsmnt., limestone courthouse, etc. $500,000. L. C. Winterton, Pascagoula, engr. CD 9/15—ENR 9/18.

★**Mo., Kansas City**—Kansas City Housing Auth., c/o E. B. Murry, Dirks Bldg., 401 unit housing, Project MO-2-1, $2,197,000, and 340 unit housing, Project MO-2-2, $1,809,000. USHA allot. CD 10/7—ENR 10/9.

★†**Mont., West Yellowstone**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., abandoned plans for Armored Division cantonment. $22,800,000. CD 11/14—ENR 11/30.

N. J., Bound Brook—Bound Brook Hospital Assoc., 507 Church St., plans by M. Weinstein, 93 Court St., Brooklyn, N. Y., 4 story, bsmnt., 70x90 ft., brick, steel hospital addn., alterations, Church St.

N. Y., Astoria (sta. Long Island City)—Bd. Educ., 49 Flatbush Ave. exten., Brooklyn, P.S.2, addn., 75 St. and 24 Ave. $480,500.

★**N. Y., Brooklyn**—Bd. Educ., 49 Flatbush Ave. exten., P.W. 44, Madison St., Throop and Putnam Aves., $1,759,680; P. S. 249 (Junior High School) vicinity Fenimore St. and New York Ave., $1,692,000; P. S. 16, addn., Wilson St. and Bedford Ave., $1,380,500.

N. Y., Corona (sta. Flushing)—Dpt. P. Wks., Municipal Bldg., New York, Corona Health Center. $437,650.

†**N. Y., Elmira**—City plans by Haskell, Considine & Haskell, 612 Hulett Bldg., school addn., Docket N. Y. 30-139. $83,125. **DPW.** CD 12/3—ENR 12/11.

N. Y., Jamaica—Dpt. P. Wks., Municipal Bldg., New York, Jamaica West Health Substations A and B, Queens, $270,000.

★**N. Y., New York**—Bd. Educ., 49 Flatbush Ave. exten., Brooklyn, P. S. 22 (Junior High School), vicinity 167 St. and College Ave., Bronx Boro, $1,719,000; P. S. 33, vicinity 28 St., 9 Ave., Manhattan Boro, $1,845,700; P. S. 117, vicinity E. 115 St., Manhattan Boro, $2,019,350.

★**N. Y., New York** — Dpt. Hospitals, 125 Worth St., power plant expansion, Fordham Hospital, Bronx Boro, $825,000.

N. Y., New York—Dpt. P. Wks., Municipal Bldg., Mott Haven Health Center, $254,170.

★**N. Y., New York**—Bd. Educ., 49 Flatbush Ave. exten., Brooklyn, P.S. 192, vicinity 137 St. and Bway. $1,412,250.

N. Y., New York—Dpt. P. Wks., Municipal Bldg., lower East Side Health and Teaching Center, $342,367.

†**N. Y., Watertown** — Bd. Trustees Mercy Hospital, plans by P. C. Reilly, 111 5 Ave., New York, N. Y., Mercy Hospital addn., Docket N. Y. 30-112. $400,000. **DPW.** CD 12/3—ENR 12/11.

★**N. Y., West New Brighton (sta. Staten Island)**—New York City Housing Auth., 122 E. 43 St., New York, 350 two story, Edwin Markham Houses, on 11 acre site bounded by Richmond Terrace, N. Burgher Ave., Wayne St. and Bway. Total est. $2,030,000. Bids asked December 30 for demolition of site for above.

N. C., Tarboro—G. F. Fountain, Jr., mayor, power plant imprvs. $210,000 bond election in several months.

★**N. C., Winston-Salem** — Winston-Salem Housing Auth., J. C. Whitaker, chn., 160 unit housing, Project NC-12-1 $645,000, and 178 unit housing, Project NC-12-2 $759,000. USHA allot. CD 7/29—ENR 7/31.

★**O., Cleveland**—National Advisory Com. for Aeronautics, E. R. Sharp, constr. administrator, Langley Field, Hampton, Va., re-

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PUBLIC BLDGS. (Proposed Work, Cont'd.) frigerated air wing tunnel bldg., Cleveland Airport. $700,000.

★†O., **Kings Mills**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., Kings Mills Ordnance Plant, vicinity here. Remington Arms Co., Inc., Barnum Ave., Bridgeport, Conn., to design and prepare plans.

Okla., Tulsa—Voted bonds reconstructing 2 firestations, etc. $318,000. J. Koberling, 1400 S. Boston Ave., archt. CD 11/14—ENR 11/20.

†**Ore., Astoria**—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., 100 dwellings, near Burch St. and U. S. Hy. 30 intersection. CD 10/9—ENR 10/16.

Ore., Parkrose—School Dist. 3, Court House, Portland, plans by T. E. Phillips, Pearson Fourth Ave. Bldg., Portland, school, gym. addns. $397,246. Seeking DPW funds.

†**Ore., Pendleton** — Umatilla Co. plans by C. B. Miller, Pendleton, 1 story, bsmnt., 46x64 ft., brick health center, Docket Ore. 35-132. $30,620. **DPW.** CD 12/3—ENR 12/11.

★†**Pennsylvania**—U. S. Eng., 1 and Douglas Sts. N.W., Wash., D. C., ammunition storage depot (concrete igloos), Franklin Co. $20,000,000.

Pa., Bedford—Bedford School Dist., E. R. Robb, superv. principal, Bedford, plans by Hunter & Caldwell, 11 Ave., Altoona, rebuilding high school. $150,000. CD 12/2—ENR 12/4.

★†**Pa., Erie**—General Electric Co., 1 River Rd., Schenectady, N. Y., and Erie Works, H. L. R. Emmet, works mgr., Erie, additional bldgs. to house arms mfg. unit, Lawrence Park. Over $2,000,000, incl. equip. Defense Plant Corp. will finance.

★**Pa., Washington** — Washington County Housing Auth., 100 unit housing, Project PA-17-1 $530,000, and 46 unit housing, Project PA-17-2 $261,000. USHA allot. CD 3/13—ENR 3/20.

†**Tenn., Chattanooga** — City, Oak Grove School addn., Docket Tenn. 40-162. $97,500. **DPW.**

Tenn., Nashville — State Bd. Institutions, Nashville, unit State School for Blind. $150,000.

Tenn., Union City — Union City Housing Auth., B. E. Cox, chn., 50 unit housing, Project TENN-9-1 $224,000, and 40 unit housing, Project TENN-9-2 $175,000. USHA allot. CD 6/13—ENR 6/19.

†**Tex., Beaumont**—City voted bonds hospital, Docket Tex. 41-244. $350,000. **DPW.** Stone & Pitts, 1200 Goodhue Bldg., archts. CD 12/4—ENR 12/11.

†**Tex., Channelview**—Dist. Trustees Channelview Independent School Dist., plans by Hedrick & Lindsley, Inc., So. Standard Bldg., Houston, 1 story, 55x219 ft. brick, concrete school, Docket Tex. 41-321. $150,000. **DPW.** CD 12/3.

†**Tex., Freeport**—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., 200 defense housing units, Clute-Lake Jackson Rd. CD 9/5—ENR 9/11.

†**Tex., Lubbock**—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., 140 defense housing units.

★**Tex., Lubbock**—Voted bonds school, $185,000; 1 story high school, $275,000. CD 9/15—ENR 9/18; 1 story school, $200,000, CD 9/17—ENR 9/25. Haynes & Strange, Myrick Bldg., archts.

Tex., Mineral Wells — Mineral Wells Independent School Dist. plans by P. M. Geran, 806½ Burnett St., Fort Worth, school, Docket Tex. 41-901. $250,320. **DPW.** CD 11/7—ENR 11/13.

†**Tex., Palacios**—Palacios Independent School Dist. plans by Hedrick & Lindsley, Inc., So. Standard Bldg., Houston, school, Docket Tex. 41-902. **DPW.** CD 11/7—ENR 11/13.

†**Tex., San Antonio**—U. S. Eng., Federal Bldg., Galveston, fireproof aviation medical research bldg., Randolph Field. $150,000.

†**Tex., Victoria**—U. S. Eng., Federal Bldg., Galveston, additional ordnance department storage bldg. unit. $65,000.

†**Va., Camp Lee**—U. S. Eng., 1 and Douglas Sts. N.W., Wash., D.C., enlarging QM Officers School. $206,712.

†**Va., Fort Monroe**—U. S. Eng., 1 and Douglas Sts. N.W., Wash., D. C., additional bldgs., Coast Artillery Candidate School. $152,249.

†**Va., Newport News**—City, revised plans hospital, Docket Va. 44-121, $179,320. **DPW.** CD 9/4—ENR 9/11.

†**Va., Norfolk**—City plans by B. F. Mitchell, Flat Iron Bldg., Norfolk, new wing and nurses home at Norfolk County Hospital, Docket Va. 44-103. $240,000. **DPW.** CD 9/4—ENR 9/11.

†**Va., Norfolk**—School Bd. plans by Vernon A. Moore, New Monroe Bldg., school, Docket Va. 44-905. **DPW.**

†**Va., Norfolk**—City, C. B. Borland, city mgr., plans by C. A. Neff, Western Union Bldg., auditorium and recreation center, Docket Va. 44-114. $353,000. **DPW.** CD 10/17—ENR 10/23.

†**Wash., Des Moines**—Union High School Dist. R, plans by W. Mallis, Lyon Bldg., Seattle, brick concrete high school, Docket 45-107. $400,000. **DPW.**

Wash., Spokane—School Dist. 81, 503 W. 4 St., plans by G. M. Rasque, Washington Trust Bldg., 168x225 ft., rein.-con. gym-

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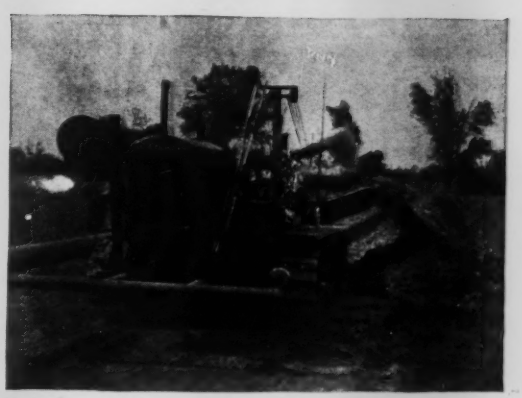

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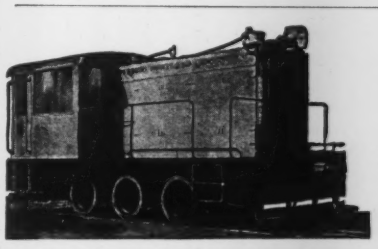

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PUBLIC BLDGS. (Proposed Work, Cont'd.

nasium-auditorium, $375,000; 1 story, bsmnt., brick, concrete trade school addn., $40,638. DPW funds sought.

†**Wash., Tacoma**—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., 400 homes, Pine St. between 35 and S. 38 Sts. CD 10/9—ENR 10/16.

Wash., Tacoma—Clover Park School Dist., c/o Mrs. I. Mann, Box 675, Route 8, plans by C. V. and C. R. Rueger, Puget Sound Bank Bldg., high school and grade school addns. $350,000. Applied to DPW. CD 10/8—ENR 10/6.

★**Wis., Manitowoc**—Manitowoc Co. rejected bids Dec. 2, asylum Bldg. $500,000. Postponed until after national emergency. CD 12/9—ENR 12/11 under LB.

†**Alaska, Ketchikan**—City, City Hall, plans by H. B. Foss, Juneau, 2 story, part bsmnt., 59x113 ft. rein.-con. school, Docket Alaska 50-112. $125,085. **DPW.** CD 12/3—ENR 12/11.

†**Alaska, Sitka**—City, plans by H. B. Foss, Juneau, 2 story, bsmnt., 58x85 ft., rein.-con., frame school, Docket 50-101. $133,000. **DPW.** CD 12/3—ENR 12/11.

†**Dutch Guiana, Paramaribo**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., barracks, etc. $350,000.

Alta., Edmonton—Recreation bldg., hockey rink, basketball floor, physical training floor and indoor swimming pool. $250,000. A. W. Haddow, City Hall, engr.

Ont., Hamilton—Wartime Housing Ltd., 55 York St., Toronto, 200 dwellings. $310,000.

Ont., Islington—Etobicoke Twp., 229 Greenview Blvd. S. Plans by J. B. Parkin, 1104 Bay St., Toronto, school.

★**Ont., Ottawa** — Secy. Dpt. Munitions & Supply, Ottawa, bids soon, temporary timber office bldg., for R.C.A.F., Lisgar St., rear of Cartier Bldg., for Dpt. National Defense for Air, Ottawa. About $600,000. C. D. Sutherland, Dpt. P. Wks., archt.

★**Que., Almaville**—Dominion Govt., Ottawa, Ont., munition plant, Lac a la Tortue, near here. $1,000,000. Dpt. National Defense, Ottawa, Ont., archts. Dpt. Munitions & Supply, Ottawa, Ont., engrs.

★**Que., Montreal**—Dominion Govt., Ottawa, Ont., plans by Dpt. National Defense, Ottawa, Ont., ordnance department bldg. $700,000. Dpt. Munitions & Supply, Ottawa, Ont., engrs.

BIDS ASKED

Bids Asked December 22

†**Conn., Stratford**—Town, Stonybrook School, brick, steel, Docket Conn. 6-128. $135,000. **DPW.** F. Beckwith, 19 Post Office Arcade, Bridgeport, archt. CD 10/30—ENR 11/6.

†**Mass., Watertown**—Con. Q.M., Harbor Defenses of Boston, Army Base, Boston, furnishing, fabricating, del., erecting, painting structural steel for exten. Bldg. 311, 1 story, 160x462 ft., equipped with craneways, Watertown Arsenal; adv. ENR 12/18. CD 12/11.

N. B., Edmundston—Secy. Dpt. Munitions & Supply, Ottawa, Ont. camp bldgs., army camp. About $300,000.

Ont., London—Secy. Dpt. Munitions & Supply, Ottawa, standard wooden camp bldgs., Walseley Barracks, for Dpt. National Defense, Ottawa, Ont. $300,000.

Que., St. Hyacinthe—M. A. David, city clk., 2 story, bsmnt., 120x120 ft., brick, rein.-con. technical school, rein.-con. fdn. $150,000. G. R. Richer, 242 Girouard Blvd., archt.

Bids Asked December 23

†**La., New Orleans**—Con. Q.M., P. O. Box 3248, Sta. D, 4566 St. Claude Ave., additional temporary housing, utilities, Quartermaster Port Troop Facilites, Jackson Barracks.

†**N. Y., Watervliet**—Con. Q.M., Watervliet Arsenal, constructing, completing, not incl. structural steel, for 1 and 2 story, 242x401 ft. brick, glass tile, concrete manufacturing bldg., 1 and 2 story, 102x322 ft. field service (tank) repair bldg.; adv. ENR 12/18.

†**Pa., Middletown**—U. S. Eng., 332 Post Office Bldg., Baltimore, Md., officers quarters, Olmsted Field.

†**Va., Gravelly Point**—Pub. Bldgs., Admin., 7 and D Sts. S.W., Wash., D. C., exten. North End Terminal bldg., Washington National Airport. CD 12/11.

Bids Asked December 24

†**Pa., Pulaski** — Beaver County Housing Auth., Monaca, 100 defense housing units, Pulaski Twp., Project 36055X, for USHA. Extended date. CD 12/1.

Bids Asked December 26

†**Mich., Center Line** — Housing Auth., 24 housing units, Project Mich. 20044X, for USHA.

†**Oregon**—U. S. Eng., 628 Pittock Blk., Portland, 15 kv. metal-clad circuit breakers for Bonneville Powerhouse, Inv. 698-42-363.

†**Ore., Portland**—U. S. Eng., 628 Pittock Blk., Portland, cold storage room and refrigeration sys. for fur storage, in Warehouse Bldg. T-706, Portland Air Base, Inv. 698-42-356.

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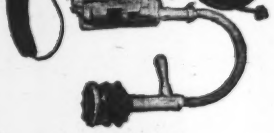

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PUBLIC BLDGS. (Bids Asked, Cont'd.)

Bids Asked December 27

†**Wash., Ampere**—Bonneville Power Admin., P. O. Box 3537, Portland, Ore., furnishing 26 instrument transformers for substation, Inv. 3455.

Bids Asked December 29

†**Ariz., Fort Huachuca**—Con. Q.M., Fort Huachuca, 639 bldgs., complete with utilities to complete Triangular Division Camp. CD 7/29—ENR 7/31.

†**Ga., Fort Benning** — U. S. Eng., Federal Bldg., Mobile, Ala., 1 story, 60x133 ft. storehouse. Lawson Field.

†**Wash., Fort Lewis**—U. S. Eng., Fort Lewis, housing for Medical Sanitary Co. Extended date. CD 12/22.

Bids Asked December 30

★**Calif., Los Angeles**—Los Angeles City Housing Auth., 1031 S. Bway., 800 unit Aliso Village housing, Project Cal. 4-5, Mission Rd., Aliso and 1 Sts. $3,481,000. USHA. Extended date. CD 12/3—ENR 12/11.

★**Calif., Los Angeles** — Los Angeles City Housing Auth., 1031 S. Bway., 260 unit Pico Gardens Housing, Project Cal. 4-2, 3 and Gless Sts. $1,309,000. USHA. Extended date. Project Architects Associated, 608 Chamber of Commerce Bldg., archts. CD 12/8—ENR 12/11.

Ga., Thomasville — Thomasville Housing Auth., 36 unit housing, Project GA-24-1 and 60 unit housing, Project Ga-24-2. USHA.

†**La., Shreveport**—U. S. Eng., Vicksburg, officers quarters, OQ-40, motor repair shop, Sp. 14, etc., Barksdale Field.

N. C., Concord—Concord Housing Auth., 46 unit housing, Project NC-8-1 and 46 unit housing, Project NC-8-2. USHA. Extended date. CD 12/1—ENR 12/4.

†**Wash., Bremerton** — Consolidated School Dist. 100-C, Kitsap Co., brick, veneer East Park School. $150,000. **DPW.** Naramore & Brady, Dexter Horton Bldg., Seattle, archts. CD 9/25—ENR 10/2.

Bids Asked January 2

D. C., Wash.—Alley Dwelling Auth., 1300 E St. N.W., Wash., D. C., James Creek Housing Project D.C. 1-3, Half, Canal, M and O Sts. USHA. Extended date. CD 12/8—ENR 12/11.

†**Tex., Corpus Christi**—City, A. C. McCaughan, mayor, health center bldg., Tex. 41-184. $100,000. **DPW.** Hamon & Co., Jones Bldg., archt. F. T. Drought, Frost Bldg., San Antonio, engr. CD 10/15—ENR 10/23.

Bids Asked January 4

Ala., Anniston—Anniston Housing Auth., 92 unit housing, Project Ala. 4-2. USHA. Extended date. CD 11/17—ENR 11/20 under BA.

Bids Asked January 6

Ala., Montgomery — Montgomery Housing Auth., 212 unit housing, Project Ala-6-3 and 44 housing, Project Ala-6-5. Extended date. USHA. CD 11/11—ENR 11/13.

N. C., Asheville—Asheville Housing Auth., 82 unit housing, Project NC-7-1, and 90 unit housing, Project NC-7-2. USHA. Extended date. CD 12/8—ENR 12/11.

Wis., Waterloo—Waterloo Water & Light Comn., A. Gorder, pres., City Hall, altering, enlarging municipal electric generating and central heating plant bldg., etc. Commercial Testing & Eng. Co., 307 N. Michigan Ave., Chicago, Ill., engrs.; adv. ENR 12/18.

Wis., Waterloo—Water & Light Comn., Waterloo, altering, enlarging electric generating and central heating plant. $104,000. Commercial Testing & Eng. Co., 307 N. Michigan Ave., Chicago, Ill., engrs.

Bids Asked January 7

†**N. Y., Brooklyn**—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., instrument shop, Coast Guard Air Station, Floyd Bennett Airport.

†**Oregon-California** — Bureau Reclamation, Klamath Falls, Ore., 4 room residence, Pump. Plant D, Modoc Unit, Tule Lake Div., Klamath Project, Spec. 1602-D.

†**Tex., Corpus Christi**—R. B. Fisher, supt. Schools, Contr. 3, school, Tex. 41-144. $200,000. **DPW.** Brock, Roberts & Anderson, c/o Jones Bldg., archts. CD 9/10—ENR 9/18.

†**Wash., Keyport**—Puget Sound Navy Yard, Bremerton, 61x121 ft. foundry and pattern shop, 33 ft. high, 100x156 ft. Barrack Bldg. 35 addn., and 53x153 ft. Storehouse 12 addn., steel, rein.-con., Naval Torpedo Station, Spec. 10771.

Bids Asked January 8

N. J., Burlington — Burlington Housing Auth., City Hall, 90 unit housing, Project NJ-20-1. USHA. Extended date. CD 12/9—ENR 12/11.

Pa., Bethlehem—Bethlehem Housing Auth., H. Pfeifle, chn., 250 unit housing, Project Pa-11-1. USHA. Extended date. CD 12/8—ENR 12/11.

Bids Asked January 9

Ky., Somerset—Somerset Municipal Housing Comn., 34 unit housing, Project Ky-8-1. USHA. Extended date. CD 12/8—ENR 12/11.

Bids Asked January 13

Ia., Slater—P. Rood, town clk., electric light and power plant. Over $60,000. R. W. Gearhart, 349 21 St. S.E., Cedar Rapids, engr. CD 9/23—ENR 9/25.

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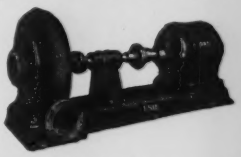

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PUBLIC BLDGS. (Bids Asked, Cont'd.)

Bids Asked January 14

Ala., Tarrant—Tarrant Housing Auth., 56 unit housing, Project Ala. 13-1. USHA. Extended date. CD 11/11—ENR 11/1[illegible]

Bids Asked January 15

N. J., Atlantic City—Atlantic City Housing Auth., 156 unit housing, Project N. J. 14-1. USHA. Extended date. CD 12/8—ENR 12/12.

Pa., Erie—Erie Housing Auth., J. A. Schmidt, man. dir., 207 Hays Bldg., 224 unit housing, Project Pa. 13-1. USHA. CD 11/12—ENR 11/13.

Pa., Monaca—Beaver County Housing Auth., 104 unit housing, Project Pa. 14-1, and 56 unit housing, Project Pa. 14-2. USHA. Extended date. CD 11/17—ENR 11/20.

Bids Asked January 16

Pa., Homestead—Allegheny County Housing Auth., 201 County Office Bldg., Pittsburgh, 182 unit housing, Project Pa. 6-4. USHA. CD 1/23/40—ENR 1/25/40, under Pittsburgh.

Bids Asked January 20

N. J., Long Branch—Long Branch Housing Auth., City Hall, 82 unit housing, Project N. J. 8-2. USHA. Extended date. CD 12/8—ENR 12/11.

N. Y., Tuckahoe—Tuckahoe Housing Auth., Village Hall, 58 unit housing, Project N. Y. 8-1. USHA. Extended date. CD 12/8—ENR 12/11.

O., Hamilton—Hamilton Housing Auth., 142 unit housing, Project Ohio 15-1. USHA. Extended date. CD 12/8—ENR 12/11.

Bids Asked About February 15

★**Wis., Superior**—Superior Housing Auth., J. Conroy, exec. dir., 156 unit housing, Proj. Wis. 1-1. $675,000. USHA. Roland C. Buck, Inc., 1223 Tower Ave., engr. CD 11/12—ENR 11/20.

★**†Pa., Braddock**—Carnegie Illinois Steel Corp., M. W. Reed, ch. engr., Carnegie Bldg., Pittsburgh, 2 blast furnaces. Defense Plant Corp. will finance. CD 8/5—ENR 8/7.

★**†Tex., Marshall**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., plant for manufacture TNT and other wartime explosives. Total est. $48,000,000. CD 5/13—ENR 5/15.

LOW BIDDERS

†California—Bureau Reclamation, Old Post Office Bldg., Sacramento, Dec. 8, hatchery bldg., Coleman Station, migratory-fish control, Kennett Div., Central Valley Project, Spec. 1014, from Grant L. Miner, P. O. Box 192, Palo Alto. **$56,866.** CD 1/3—ENR 11/6.

†Ill., Scott Field—U. S. Eng., 816 U. S. Court House & Custom House, St. Louis, Mo., Dec. 5, ice storage bldg., officers' mess, motor repair shop and oil storage house, from Evans Constr. Co., 104 N. 6 St., Springfield. **$57,750.** CD 12/1.

★**Kan., Kansas City**—City, c/o C. A. Lowder, Dec. 10, municipal power plant addn., from S. Patti Constr. Co., 1114 Bway., Kansas City, Mo. **$436,000.** Est. $500,000. CD 11/11—ENR 11/13.

†Md., Baltimore—Maryland Drydock Co., Fairfield, Baltimore, Dec. 9, 1 and 2 story, 135x160 ft. machine shop, for Navy Dpt., from Baltimore Contractors, 23 N. Central Ave. **$120,000** plus; pier and dock, from Kaufman Constr. Co., 1505 Rac St., Phila., Pa. CD 12/1—ENR 12/4.

Minn., New Ulm—A. D. Sannwald, city clk., Dec. 11, furnishing, installing 5,000 kw. turbine generator in municipal power plant, from Westinghouse Electric & Mfg. Co., 2303 N.E. Kennedy St., Minneapolis. **$120,000.** CD 12/9—ENR 12/4.

†Mo., Waynesville—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., Dec. 12, school, from Busboom & Rauh, Salina, Kan. **$209,000.** CD 12/10.

★**†Mont., Fort Peck**—U. S. Eng., 1201 Davidson Bldg., Kansas City, Mo., Dec. 12, power house superstructure surge tank bldg., installing penstocks and butterfly valves for Fort Peck Project, from Fegles Constr. Co., 711 Wesley Temple Bldg., Minneapolis, Minn. **$3,407,026.** CD 11/18—ENR 11/27.

★**O., Cleveland** — Cleveland Metropolitan Housing Auth., E. J. Bohn, secy., West Mall Dr., Dec. 9, Outhwaite Housing Project 2, brick, steel, concrete, from Maurice L. Bohn, P. O. Box 1500, Bridgeport, Conn. **$4,943,000.** USHA. CD 12/1—ENR 12/4.

†O., Cleveland—National Advisory Com. for Aeronautics, E. Sharp, constr. administrator, Langley Field, Hampton, Va., Dec. 3, 2 story, 58x267 ft. brick, steel, concrete office bldg. for engine research laboratory, Cleveland Airport from Leo W. Schmidt, Inc., 10000 Granger Rd. **$272,000.** CD 11/18—ENR 11/27.

†Ore., Portland—Pub. Bldgs. Admin., 7 and D Sts. S.W., Wash., D. C., Dec. 3, 85 unit defense housing, Project 35021, from B. H. Sheldon, 2022 W. 3 Ave., Spokane, Wash. **$229,960.** CD 11/24.

†Pa., Charleroi—U. S. Eng., Federal Bldg., Pittsburgh, Dec. 8, 1 and 2 story storehouse, U. S. Boat Yards, from Berkeley Constr. Co.,

PUBLIC BLDGS. (Low Bidders, Cont'd.)

Martinsburg, W. Va. **$48,911.** CD 11/18—ENR 11/27.

★**Tex., Stephenville**—Bd. Directors A. & M. College, F. M. Law, pres., College Station, Dec. 6, girl's and boy's dormitories, and agricultural bldg. for John Tarleton Agricultural College, from W. S. Bellows Constr. Co., Bankers Mortgage Bldg., Houston, **$533,561*****electrical work, from Hensley Electric Co., 2245 N. Main St., Fort Worth, **$29,201** ***plumbing, heating, from D. Vickers, Sweetwater, **$122,900.** CD 11/24—ENR 11/27.

★†**Utah, Ogden**—U. S. Eng., 751 S. Figueroa St., Los Angeles, Calif., aircraft repair shop, Hill Field, from Robert E. McKee, 5824 S. Central Ave., Los Angeles, Calif., **$1,029,700.** CD 11/19—ENR 11/27.

CONTRACTS AWARDED

†**Arizona-California-Nevada**—Bureau Reclamation, Custom House, Denver, Colo., furnishing equip. for modernizing oil circuit breakers in switchyard, Boulder Dam power plant, to Westinghouse Electric & Mfg. Co., G. & E. Bldg., Denver, Colo. **$120,000.** Bids 11/18.

†**Arizona-California-Nevada**—Bureau Reclamation, Custom House, Denver, Colo., 3 transformers for switchyard and power plant, Boulder Dam, Colorado River, to Westinghouse Electric & Mfg. Co., G. & E. Bldg. Denver, Colo. **$325,120.** Bids 11/6. CD 10/14—ENR 10/16.

★†**California**—Bureau Reclamation, Custom House, Denver, Colo., three 25,000 kilovolt-ampere power transformers for Keswick power plant, Central Valley Project, Spec. 1008, to General Electric Co., 650 17 St., Denver, Colo. **$550,785.** CD 10/15—ENR 10/23.

★†**Calif., Los Angeles**—Defense Plant Corp., 811 Vermont Ave. N.W., Wash., D. C., concrete work and grading for aluminum reduction plant, 31 bldgs., 190 St. between Western and Normandie Aves., to P. J. Walker Co., 3900 Whiteside Ave.; structural steel, to Bethlehem Steel Co., 11,100 S. Central Ave. Est. **$5,000,000.** H. T. Cory, superv. engr. at site.

★**Calif., Los Angeles**—Housing Auth. of City of Los Angeles, 1031 S. Bway., general contract 214 unit housing, Estrada Courts, Project Cal. 4-7, to H. Gorelnik, 117 S. Poinsettia Pl., **$461,249*****plumbing, to Wilner Supply Co., 5812 W. Pico Bl., **$68,249*****electrical work, to Vancott Co., 5024 W. Washington Bl., **$30,878.** Grand total $560,376. USHA. Bids 11/4. CD 11/9—ENR 11/13, under LB.

†**Calif., Sacramento**—U. S. Eng., Federal Bldg., steam boiler plant, McClellan Field, to C. C. Moore & Co. Engineers, 450 Mission St., San Francisco, **$238,965.**

†**Colorado**—Bureau Reclamation, Customhouse, Denver, 3 transformers and 5 oil circuit breakers for Green Mountain Power Plant, Colorado-Big Thompson Project, Spec. 1002, to Allis-Chalmers Mfg. Co., Continental Oil Bldg., Denver, **$143,350,** 7 transformers, to Pennsylvania Transformer Co., 1701 Island Ave., Pittsburgh, Pa., **$54,698** *** 47 disconnecting switches to Memco Eng. & Mfg. Co., 37-46 9 St., Long Island City, N. Y., **$10,570.** Grand total $208,618. Bids 11/4. CD 10/8—ENR 10/16.

★†**Ill., Joliet**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., 10 additional warehouses, Elwood Ordnance Plant, to Sanderson & Porter, 52 William St., New York, N. Y., **$700,000.** CD 8/21—ENR 8/28.

†**Ill., Proving Ground**—U. S. Eng., brick, concrete administration bldg., to James Burton Co., 179 W. Washington St., Chicago. **$157,300.** Bids 11/18. CD 11/3—ENR 11/6.

Kan. Winfield—F. E. Jarvis, mayor, installing power piping, power plant, to Power Serv. Co., Wesley Temple Bldg., Minneapolis, Minn., **$25,775.** Est. $25,000. Bids 12/8. CD 11/17—ENR 11/20.

†**N. J., Irvington**—F. C. Kent Co., 65 Grace St., 1 story, 100x125 ft., brick, steel airplane parts factory addn., Howard St., for Navy Dpt., to Anthony Lewis, Inc., 40 Clinton St., Newark. **$76,000.** CD 11/5—ENR 11/13.

★**N. Y., Central Islip**—Comr. Mental Hygiene, State Office Bldg., Albany, general contract infirmary bldg., Central Islip State Hospital, to Amsterdam Building Co., 430 Lexington Ave., New York, **$639,900*****sanitary work, to Endres Plumbing Corp., 31-55 29 St., Long Island City, **$45,200*****electrical work, to Bevis & Neuman, Montauk Hy., West Hampton, **$34,193.** Grand total $773,283. Bids 1/13. CD 11/18—ENR 11/27 under LB.

†**N. Y., Watervliet**—U. S. Eng., Watervliet Arsenal, structural steel for GL gun shop bldg. and GF new mfg. bldg., to Bethlehem Steel Co., E. 3 St., Bethlehem, Pa., **$252,300.** Bids 11/27. CD 11/18.

Que. Valleyfield—Wartime Housing Ltd., 55 York St., Toronto, Ont., 110 dwellings, to H. F. McLean, Ltd., Keefer Bldg., Montreal. Est. $200,000.

†**Tex., Victoria**—U. S. Eng., Federal Bldg., Galveston, additional ordnance department storage bldg. unit, to American Friedman Bitulithic Co., Rusk Bldg., Houston, and Victoria. Approx. **$65,000.** CD 12/1—ENR 12/18.

Tex., Winters—T. A. Smith, mayor, generating plant, to Universal Electric Constr. Co. of Alabama, Inc., Guntersville, Ala. **$160,000.** CD 11/5—ENR 11/13.

★†**Washington**—Bureau Reclamation, Custom House, Denver, Colo., furnishing 3 hydraulic turbines for Grand Coulee Power Plant, Columbia Basin Project, Spec. 1013, to Newport News Shipbuilding & Dry Dock Co., Newport News, Va. **$1,900,000.** Bids 11/19. CD 11/25—ENR 11/27, under Earthwork, etc.

★†**W. Va., Morgantown**—War Dpt., 20 St. and Constitution Ave. N.W., Wash., D. C., design and construction additional unit Morgantown Ordnance Plant, to E. I. du Pont de Nemours & Co., Du Pont Bldg., Wilmington, Del. **$15,000,000.** Additional to CD 7/10—ENR 7/17, under CA.

N. S., Halifax—Dpt. P. Wks., Ottawa, Ont., Pavilions B and C, Camp Hill Hospital, to Fundy Constr. Co. Ltd., Isleville and Russell Sts., about **$233,000.** C. D. Sutherland, c/o owner, archt.

N. S., Halifax—Dominion Govt., Ottawa, Ont., hospital addn., to Fundy Constr. Co. Ltd., 7 Russell St., **$233,335.** C. D. Sutherland, Dpt. P. Wks., Ottawa, Ont., archt.

Ont., Ottawa—Secy. Dpt. P. Wks., Ottawa, Ont., No. 6 War Bldg. (temporary office bldg.), to Pigott Constr. Co. Ltd., Pigott Bldg., Hamilton. **$328,000.** Bids 12/12, awarded 12/13. CD 12/5—ENR 12/11.

Que., Quebec West—Dominion Govt., Ottawa, Ont., 3 story, bsmnt., 40x152 ft., brick hospital wing addn., Savard Park, to F. Jobin, Inc., 86 St. Louis St., Quebec City. Est. **$150,000.** Dpt. P. Wks., associated with H. George, Dpt. Pensions & National Health, both Ottawa, Ont., archts. CD 12/5—ENR 12/11.

Que., Ste. Anne de Bellevue — Dominion Govt., Ottawa, Ont., hospital addn., to J. L. Guay & Brother, 437 Guy St., Montreal, Est. **$150,000.** Dpt. Wks., associated with H. George, Dpt. Pensions & National Health, both Ottawa, Ont., archts.

COMMERCIAL BUILDINGS

PROPOSED WORK

Calif., Santa Clara — University of Santa Clara, Santa Clara, dormitory and social hall. Over $150,000.

Calif., Santa Monica—California Hospital, 1414 S. Hope St., Los Angeles, sketches by **Walker & Eisen, 1100 Wright & Callender** Bldg., Los Angeles, convalescent hospital. $150,000. F. N. Dlouhy, 437 S. Hill St., Los Angeles, engr.

★**Kan., Wichita**—Sisters of St. Joseph, 320 E. Central St., plans bd Overend & Boucher, Brown Bldg., 10 story, brick, concrete hospital. $1,000,000. Applied to DPW for funds

Mich., Muskegon—Hackley Hospital, Forest and Clinton Sts., plans by Schmidt, Garden & Erikson, 104 S. Michigan Ave., Chicago, Ill., 4 story, bsmnt., brick, steel, rein.-con. hospital addn., plain fdn. $381,000.

N. J., Oakhurst—Walter Reade, Inc., 701-7 Ave., New York, N. Y., fifty 1½ and 2½ story, bsmnt., frame homes, Deal Rd. $350,000.

N. Y., Brooklyn—Nutine Homes, Inc., 1637 W. 11 St., plans by Seelig & Finkelstein, 153 Pierrepont St., 6 story, 85x160 ft. apartment, 161-77 Corbin Pl. $230,000.

Pa., Allentown—H. Larash, Godfrey St., 16 or more single frame dwellings, Union Blvd. and E. Tilghman St. sect. $150,000.

Pa., Allentown—F. Vargo, S. 5 St., housing development, 20 or more dwellings. $150,000.

Pa., Fullerton—E. S. Kester, 5 St., 75 single frame dwellings, Oak View Manor Area. $400,000.

Tex., Houston—Garden Villas Apartments, c/o L. H. Jolley, Esperson Bldg., bids soon, frame, steel, apartment bldg. units, rein.-con. fdn. $175,000. Mackie Kamrath, 2017 W. Gray St., archts.

Wash., Camas—Sisters of Charity, c/o Dr. A. E. Bird, 403 N.E. 5 St., hospital. $300,000.

Wis., Sheboygan—Owner, c/o Satre & Senescall, archts., 802 Michigan Ave., sketches, forty-two 3 story, bsmnt., 78x290 ft. apartment bldgs.

BIDS ASKED

Bids Asked December 23

Mass., Norwood—Norwood Hospital Corp., R. Brown, administrator, 792 Washington St., 3 story, bsmnt., brick, steel, concrete hospital, Washington St. $150,000. Stevens, Curtin, Mason & Riley, 45 Newbury St., Boston, archts. CD 3/11—ENR 3/13.

Fla., Jacksonville—Southern Bell Telephone & Telegraph Co., Hurt Bldg., Atlanta, dial exchange bldg., Monroe St. Over $200,000, incl. equip.

Ill., Maywood — Paramount Pictures, Inc., 1306 S. Michigan Ave., Chicago, theatre and stores, 5 Ave. and Warren St. $250,000. Rapp & Rapp, 230 N. Michigan Ave., Chicago, archts. CD 10/16—ENR 10/23.

CONTRACTS AWARDED

Calif., Vallejo—R. O. Long, 2364 Arkansas City (1st unit) (ten) 1 story, wood frame homes, Vallejo Highlands 1, day labor. Ultimate expenditure over **$150,000.**

Del., Newark — Delaware School Auxiliary Assn., du Pont Bldg., Wilmington, field house, to Shepheard & Co., Inc., 213 Greenhill Ave., Wilmington. Est. **$200,000.** Martin & Jeffers, du Pont Bldg., Wilmington, archts.

Ill., Chicago—Colonial Village Homes, Inc., 7558 Irving Park Rd., masonry contract, 144

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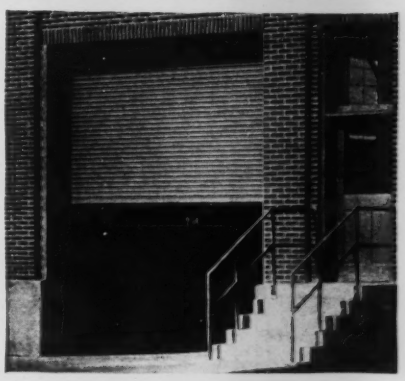

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THE KINNEAR MFG. CO.
1820-40 FIELDS AVENUE
COLUMBUS, OHIO

COMMERCIAL BLDGS. (Contracts Awarded, Cont'd.)

residences, Chicago, Oriole and Oleander Aves., to Gade & Larsen, 6818 W. Hurlburt Ave.; carpentry, to C. Pretzel, 3746 N. Pioneer Ave. Total est. about **$400,000**. B. J. Bruns, 4734 N. Hermitage Ave., archt.

Mo., St. Louis—W. F. Hellmich, 5823 Neosho St., 24 residences, 6000 block Lansdowne Ave. and 6000 block Sutherland Ave., Hampton Hills Dist. Owner builds. **$150,000.**

N. J., Totowa—Bettie Mfg. Co., Main St., Little Falls, 60 one and one half story, bsmnt., brick veneer, frame homes, near State Hy. 6, to G. Walker, 31 St. James St., Boston, Mass. **$240,000.** CD 12/2—ENR 12/4.

N. Y., Brooklyn—Bethlehem Steel Co., 25 Bway., New York, office bldg., Brooklyn Yards, to Lippe Constr. Co., 17 W. 60 St., New York. Est. **$150,000.**

N. Y., Dunkirk—G. H. Graff, c/o Graff Furniture, Dunkirk, 30 frame dwellings, separate contracts. **$150,000.**

Pa., Phila.—P. E. Kelley, Knorr St., residences. Owner builds. **$150,000.**

Tex., Harlingen—Home Builders, Inc., 1330 E. Polk St., 1 story frame dwellings, utilities, etc. Owner builds **$150,000.**

Wash., Seattle—Balch & Setzer, E. 80 St. and 35 Ave. N.E., 50 houses, Wedgwood Addn., to J. Henrikson, Textile Tower. Est. **$250,000.** Thomas, Grainger & Thomas, Arcade Bldg., archts.

INDUSTRIAL BUILDINGS

PROPOSED WORK

Calif., Berkeley—PLANT—American Forge Co., 750 Potter St., plant expansion. Over $100,000.

Calif., Monterey — CANNERY — Associated Sardine Canning Co., plans by C. J. Ryland, 136 Bonifacio Pl., part 1 and 2 story, 100x230 ft., wood frame cannery.

Calif., Redwood City — PLANT — National Motor Bearing Co., 1100 78 Ave., Oakland, rein.-con. plant. $200,000. W. H. Ellison, Pacific Bldg., San Francisco, engr.

Calif., Santa Ana—PLANT—Western Ordnance Co., C. Holles, 218 N. Sycamore St., munitions plant, on Santa Ana River, 4 mi. east of Huntington Beach, 8 mi. south west of here.

★**Calif., Sunnyvale**—PLANT EXPANSION—Joshua Hendy Iron Wks., Sunnyvale, steam turbine unit plant exansion. Over $500,000.

Conn., Bridgeport — FOUNDRY — Peerless Aluminum Castings Co., 55 Andover St., soon lets contract, 1 story, 65x144 ft., brick, steel foundry addn. $40,000. P. Petrofsky, 95 Main St., engr. CD 12/2—ENR 12/4.

Conn., Greenwich — FACTORY — Electrolux Corp., Forest Ave., soon lets contract 2 story, 101x166 ft., brick, steel factory. $75,000.

Ill., Chicago—FACTORY—Central Pattern & Fdry. Co., 3737 S. Sacramento Ave., plans completed by Kocher & Larsen, 506 W. 63 St., 1 and 2 story, 100x125 ft. factory, 38 St. and Sacramento Ave. $50,000.

Ind., Evansville—PLANT—Excel Mfg. Co., W. 3 St., A. Moore, bids in January, enlarging plant. $40,000 or more.

Ind., Evansville—TERMINAL—Hayes Trucking Corp., C. C. Berry, mgr., brick, steel terminal and garage. $60,000.

Ind., Evansville—PLANT—Hoosier Lamp & Stamping Co., T. J. Morton, Jr., pres., 601 W. Eichel Ave., brick, steel plant addn. $200,000 or more with equp.

Ind., Hagerstown—LABORATORY—Perfect Circle Corp., Hagerstown, testing laboratory, $125,000 or more with equip.

Kan., Wichita—PLANT—Watkins, Inc., E. A. Watkins, pres., Wichita, sketches by Forsblom & Parks, Beacon Bldg., steel and foundry plant. $200,000.

O., Cleveland—FACTORY, etc.—Cleveland Worm & Gear Co., H. Single, pres., 3243 E. 80 St., 1 story, 40x80 ft., and 2 story, 40x60 ft., brick, steel, factory and office addns. $40,000. George S. Rider Co., Terminal Tower, engrs.

O., Cleveland—FACTORY— Harris-Seybold-Potter Co., 4510 E. 71 St., plans by W. H. Smith, 2400 Lee Rd., 3 brick, steel, factory addns. $40,000.

O., Cleveland—FACTORY—U. S. Steel & Wire Spring Co., C. Schultz, pres., 7800 Finney Ave., 1 story, brick, steel factory addn. $40,000.

O., Massillon — FACTORY — Tyson Roller Bearing Co., Massillon, sketches by F. K. Draz and A. Scholl, 13124 Shaker Square, Cleveland, 1 and 2 story, brick, steel, factory. $50,000.

Pa., Mount Joy—PLANT—American Expansion Bolt Co., York, imprv., altering, expansion, addn. recently acquired New Standard Corp. plant. Over $40,000.

Pa., Phila.—PLANT—Fischer Machine Co., 11 and Vine Sts., plant addn., 11 and Vine Sts. $100,000.

Pa., Phila.—PLANT—Owner, c/o C. H. Fries, archt., 3701 N. Broad St., plant addn. over $40,000.

Pa., Wilkes-Barre — SUPER STATION — American Oil Co., American Bldg., Baltimore, Md., I. Savitz in charge, c/o owner, master super service station, 109x214 ft. site, South River and W. Market Sts. $50,000 with equip.

Tex., Beaumont—STORAGE, etc.—Stedmen Co., Park and Bowie Sts., 40x100 ft., rein.-con., brick storage and warehouse bldg. $40,000. Stone & Pitts, Goodhue Bldg., engrs.

Tex., Houston—PLANT—Stokeley Bros. & Co., Inc., 951 N. Meridian St., Indianapolis, Ind., and Harlingen, food canning and packing plant. $100,000 incl. equip.

Tex., Odessa—REFINERY, etc.—Stanolind Oil & Gas Co., Dallas and Fair, Bldg., Fort Worth, refinery expansion, connecting lines, etc. $250,000.

Tex., Taylor—PLANT—Taylor Pecan Co., W. C. Wofford, pres., Taylor, rebuilding pecan shelling plant. $50,000.

Wis., Fox Lake—PLANT—Central Wisconsin Canneries, Beaver Dam, 2 story, 60x120 ft. pea canning plant, steel, frame, concrete fdn., to A. E. Hutter, 600 Madison St., Beaver Dam.

Wis., Genoa—GENERATING PLANT FACILITIES, etc.—Tri-State Power Co-operative, Genoa, J. N. Gundershaug, mgr., additional facilities in connection with generating plant. $48,000 REA allot.

Wis., Green Bay—FREIGHT TERMINAL—Olson Transportation Co., 200 Mather St., plans by H. W. Williams, Northern Bldg., 1 story, part bsmnt., T shaped, 100x150 ft. freight terminal office bldg., 1 story, T shaped, 100x300 ft. garage, brick, steel, concrete fdns. CD 2/18—ENR 2/20.

Wis., Juneau—PLANT—Producers Co-operative Assn., Juneau, powdered milk plant. Over $40,000.

Wis., Walworth—FACTORY—Gillett Canning Co., Gillett, canning factory. $100,000.

★**Ontario**—PLANT—Con. Mining & Smelting Co. Ltd., Trail, B. C., magnesium production plant in Ontario. $1,000,000.

Ont., Geraldton — PLANT — Geraldton Bits Ltd., Geraldton, mfg. plant. $40,000.

Ont., London — PLANT — Coleman Packing Co., Ltd., 7 First St., 3 story, 38x110 ft., brick, concrete plant exten. J. C. Klaehn, 49 E. King St., Kitchener, engr.

Ont., St. Thomas—PLANT—Birdseye Co., Inc., Bridgeton, N. J., cold storage and freezing plant. $40,000.

Ont., Waterloo—PLANING MILL—J. Hunsberger Co. Ltd., 134 W. Erb St., planing mill and allied parts. $40,000.

Ont., Waterloo—PLANT—Ornamental Moulding & Carving Co. Ltd., 12 E. Duke St., plant. $40,000.

Que., Giffard—PLANT—Pony Brand Essence & Syrup Co. Ltd., 7 Industrial St., bids in spring, plant exten. Rousseau & Begin, 1 Ferland St., archts. $50,000. CD 11/3—ENR 11/6.

Que., Granby—MILL—Montrose Worsted Mills, Ltd., 201 St. Antoine St., mill. $40,000. Architect, c/o M. J. Israel, 5046 Grosvenor Ave., Montreal.

Que., Hull—FOUNDRY—Richards & Abra, archts., 55 Metcalfe St., Ottawa, Ont., bids soon, foundry addn., for Hull Iron & Steel Foundries, Ltd., Montcalm St. About $40,000.

Que., Lachine—PLANT—Harrington Tool & Die Co., Ltd., 201 First Ave., 2 story, brick, concrete exten. B. R. Perry, 680 Sherbrooke St., Montreal, engr.

Que., L'Anse St. Jean — PLANT — LaCompagnie d' Energie Electrique, Inc., L'Anse St. Jean, electric and lighting plant. $45,000.

Que., Montreal—MILL—B. C. Plywoods Quebec Ltd., 5327 Drake St., mill. $50,000.

Que., Montreal—PLANT—Eagle Smelting & Refining Wks., Ltd., 400 Richmond St., plans by Eliospoth & Greenspoon, 1403 Bleury St., plant addn.

Que., Montreal—PLANT—T. Pringle & Son, Ltd., engrs., 485 McGill St., Montreal, bids soon plant exten., for International Paints (Canada) Ltd., 6700 Park Ave. $42,000.

Que., Montreal—PLANT—Stuart Bros. Co. Ltd., 202 Youville St., new bids soon plant addn. $50,000. Former bids rejected. T. Pringle & Son, Ltd., 485 McGill St., engrs. CD 9/17—ENR 9/25.

BIDS ASKED

Bids Asked December 27

Tex., Greenville — FACTORY — Greenville Pants Factory, Greenville, 1 story, 20x200 ft., steel, concrete factory. J. A. Pitzinger, Southland Life Bldg., Dallas, archt. CD 10/9—ENR 10/16.

Bids Asked Before January 1

★**Pa., Williamsport**—PLANT—Hygrade Sylvania Corp., H. Ward Zimmer, genl. mgr., Emporium, 2 story, bsmnt., brick, steel radio products mfg. plant. $500,000. CD 11/25—ENR 11/27.

Bids Asked About January 8

★**O., Youngstown**—PLANT—United Fdry. Co., E. E. Tross, genl. mgr., 218 S. Phelps St., 85x275 ft., steel, glass assembly plant addn., Phelps St. $500,000.

Bids Asked

Calif., Bakersfield—MILL—C. H. Gesar, archt., Haberfelde Bldg., mill, for Bakersfield Grain Co., c/o architect. $40,000.

Calif., Los Angeles—FACTORY—West Coast Paperboard Mills, 61 St. and Eastern Ave. (selected list bidders), 60x227 ft. and 125x117 ft., bsmnt., rein.-con. factory, Eastern Ave. and 61 St., near here. $60,000. M. J. Gabrielsen, 6362 Hollywood Blvd., Hollywood, engr.

Calif., Pacific Grove — WAREHOUSE — Owner, c/o C. J. Ryland, archt., 136 Bonifacio Pl., Monterey (selected list contractors), 2 story, concrete, wood frame warehouse. $40,000. CD 11/21—ENR 11/27.

N. Y., Walton—PLANT—Breakstone Bros., A. I. Luscomb, genl. mgr., rebuilding, milk, dairy and cheese products mfg. plant. Over $40,000. CD 10/30—ENR 11/6.

Pa., Munhall—SHOP, etc.—Carnegie Illinois Steel Corp., American Shear Knife Div., 5 Ave., Pittsburgh, 1 story, 80x180 ft., brick, steel, concrete industrial shop with 28x36 ft. office wing. M. W. Reed, Carnegie Bldg., Pittsburgh, co. ch. engr.

CONTRACTS AWARDED

Conn., Hamden (br. New Haven)—POWER PLANT—Acme Wire Co., 1255 Dixwell Ave., brick, steel, concrete power plant, to Mott-Mohr Constr. Co., Inc., 440 Elm St., New Haven. Est. **$60,000.** CD 12/2—ENR 12/4.

Ill., Chicago — PLANT — Newman-Rudolph Lithographing Co., 844 W. Jackson Blvd., 1 story, 85x120 ft., lithographing plant addn. to Kaiser-Ducett Co. 80 E. Jackson Blvd. Est. **$40,000.** Burnham & Hammond, 160 N. La Salle St., archts.

Ill., Chicago — FACTORY — Nutrition Research Laboratories, Inc., 332 S. Michigan Ave., factory addn., 4218 W. Peterson Ave., to J. Emil Anderson, 3659 W. Belle Plaine Ave. Est. **$40,000.** A. Epstein, 2001 P. Pershing Rd., engr.

Ill., Chicago—FACTORY—Owner, c/o general contractor, 1 story, 44x92 ft., brick factory, 1913 N. LeClaire Ave., to D. Gowdy, 6138 W. North Ave. Est. **$45,000.** J. H. Klafter, 100 N. La Salle St., archt.

N. J., Camden—SHOP—N. Y. Shipbuilding Corp., Bway., shop, to Leonard Schaefer & Co., 1310 Spruce St., Phila., Pa. Est. **$432,000.** S. Jelinek, Spruce St., Phila., Pa., archt.

N. J., Carlstadt—FREIGHT DISPATCH—Moran Transportation Lines, Inc., 508 W. 40 St., New York, N. Y., 1 and 2 story, 30x160 ft. freight dispatch bldg., 1 story, 34x38 ft. garage, both brick, cement block, Paterson Plank Rd., to William L. Blanchard Co., 45 Poinier St., Newark, **$40,000.** R. A. Mouri, 697 Potomac Ave., Buffalo, N. Y., archt.

N. J., Hillside (br. Elizabeth)—SHOP—D. O. Evans, 1445 N. Broad St., 1 story, 65x185 ft., brick, steel machine and assembly shop, Evans Pl. Owner builds. **$40,000.** J. Wind, Jr., 1445 N. Broad St., archt. Ferdon Equip. Eng. Co., 96 Main St., Newark, lessee.

N. J., Kearny (br. Arlington)—SHOP—Acme Tool & Machine Co., 576 Davis Ave., 1 story, 100x100 ft., concrete block, brick, steel machine shop addn., to Damon & Douglas Co., 605 Broad St., Newark, **$50,000.** CD 12/1—ENR 12/4.

N. J., Mahwah — FOUNDRY — American Brake Shoe & Fdry. Co., Ramapo Valley Rd., 1 story, 50x125 ft., brick, steel foundry addn., altering storage bldg., 1 story charging shed addn., Ramapo Valley Rd., to J. H. Steel & Sons, Inc., 48 N. 2 St., Paterson. **$55,000.**

N. C., Raleigh—BOTTLING PLANT—Seven-Up Bottling Co., 520 Fayetteville St., 2 story bottling plant, South and McDowell Sts., to J. W. Coffey & Son, 209 S. McDowell St. **$40,000.**

O., Cleveland—FACTORY—Acrods Co., R. Rogers, production mgr., 4437 E. 49 St., 1 and 2 story 109x293 ft., brick, steel factory addn., to A. M. Higley Co., 2036 E. 22 St. Est. **$200,000.** CD 12/3—ENR 12/11.

O., Cleveland — FACTORY — Apex Electric Mfg. Co., E. L. Frantz, pres., 1070 E. 152 St., 1 story, 30x140 ft., brick, steel, factory addn. to Bolton-Pratt Co., 1276 W. 3 St. Est. **$40,000.** W. Hatch, Hippodrome Bldg., engr. awarded 12/3.

O., Cleveland—FACTORY—Bishop & Babcock Mfg. Co., F. N. Mizer, pres., 4901 Hamilton Ave., 1 story, 30x170 ft., brick, steel, factory addn., to J. E. Christian Co., 5606 Curtiss Ave. **$40,000.** Awarded 12/4. CD 11/26—ENR 12/4.

O., Cleveland—FACTORY—Feick Mfg. Co., 10225 Meech Ave., 1 story, 34x125 ft., brick, steel factory addn., to A. MacDougall Co., 5410 Stone Ave. Est. **$40,000.** H. J. Hassler, 700 Prospect Ave., engr.

Pa., Emlenton—PLANT—Quaker State Oil Refining Corp., Oil City, G. S. Hunter, supt., Emlenton, solvent dewaxing unit addn. to crude oil refinery, separate contracts. **$40,000.-$50,000.** CD 11/18—ENR 11/27.

Pa., Harrisburg—BOTTLING PLANT, etc.—Cloverdale Spring Co., 1620 N. 7 St., brick, concrete bottling plant, garage, 18 and Paxton

INDUSTRIAL BLDGS. (Contracts Awarded, Cont'd.)

Sts., to Ritter Bros., 1511 N. Cameron St. **$58,000.**

Pa., Phila.—SHOP—Pennsylvania R.R. Co., Broad St. Station, W. D. Wiggins, ch. engr. Sys., 85x920 ft. shop, to James McGraw Co., Commercial Trust Bldg. Est. **$200,000.**

Pa., Warren — PLANT — Warren Food Lockers, 325 Penn Ave., frozen food storage plant, etc., separate contracts. **$40,000.** CD 11/24—ENR 12/11.

Pa., Williamsport—AIRCRAFT ENGINE TESTING UNIT—Aviation Mfg. Corp. (Lycoming Div.) Williamsport, 6 aircraft engine testing unit, incl. control room, concrete stacks, etc., to Charles H. Roller, 413 Stevens St. Est. **$75,000.**

Pa., York—PLANT—H. J. Williams Co., Inc., York, limestone quarrying and distr. plant, 168 acre site, West Manchester Twp., near here, own forces. Over **$40,000.** CD 12/1—ENR 11/11.

Wis., Beloit—SHOP—Fairbanks-Morse & Co., Beloit, 1 story, 30x187 f., brick, steel B. W. shop addn., concrete fdn., to Cunningham Bros., 359 E. Grand Ave. W. Fred Dolke, 2204 Merchandise Mart, Chicago, Ill., archt.

Wis., Green Bay—STORAGE and SHIPPING SHED—Larsen Co., 314 N. Bway., 1 and 2 story, 28x600 ft. frame storage and shipping shed, concrete fdn., to Lorens Hensen & Sons, 825 S. Howard St. C. H. Williams, 212½ Pine St., archt. CD 10/16—ENR 10/23.

Wis., Green Bay—WAREHOUSE—Owner, c/o R. W. Surplice, archt., City Center Bldg., 1 story, 56x100 ft. concrete block, steel warehouse, concrete block fdn., day labor.

Wis., Menasha — WAREHOUSE — Wheeler Transportation Co., Racine St., 1 story, 70x330 ft., concrete block, steel warehouse, concrete fdn., to Fluor Bros. Constr. Co., 48 Otter St., Oshkosh.

Wis., Rosendale — PLANT — Central Wisconsin Canneries, Beaver Dam, 1 story, 40x118 ft. corn canning plant, 1 story, 40x80 ft. kitchen-dining hall bldg., five 10x20 ft. bunk houses, etc., to A. E. Hutter, 600 Madison St., Beaver Dam.

Wis., Whitehall—PLANT—Land O' Lakes Creameries, Inc., 2201 Kennedy St. N.E., Minneapolis, Minn., general contract 2 story, 100x133 ft. milk dehydration plant, also boiler room, engine room, garage, brick, tile, concrete fdns., to John Schneider, Independence. Est. **$325,000.** CD 11/18—ENR 11/27.

Ont., Brantford — FACTORY — Brantford Coach & Body Ltd., Mohawk St., 1 story, 80x300 ft., steel, rein.-con. factory addn., day labor. **$100,000.**

Ont., Brantford — FACTORY — Waterous Ltd., Market St., 1 story, 60x220 ft., steel, concrete factory addn., day labor. **$75,000.**

Ont., Chippawa—PLANT—Alumdun Plant of Norton Co. Ltd., Chippawa, 1 story, 26x90 ft., steel frame, plant addn., sheet metal siding, to Standard Steel Constr. Co., Ltd., Port Robinson, about **$70,000.** Est. $99,100 equipped.

Ont., Galt—PLANT—Shurley Dietrich Atkins Co., Ltd., 17 Glebe St., 1 story, 118x220 ft., brick, steel plant addn., concrete fdn., St. Andrews St., to G. H. Thomas & Son Ltd., 17 Glebe St. About **$185,000.**

Ont., Hamilton—PLANT—Gartshore-Thomson Pipe & Fdry. Co., Ltd., 14 W. Stuart St., remodeling bldgs., to W. H. Cooper Constr. Co., Ltd., Medical Arts Bldg. **$40,000,** cost plus basis.

Ont., Hamilton—PLANT—Procter & Gamble Co. of Canada, Ltd., 14 Burlington St. E., 1 story, clay tile warehouse addn., concrete fdn., to W. H. Cooper Constr. Co., Ltd., Medical Arts Bldg. **$42,000.** CD 11/26—ENR 12/11.

Ont., Sarnia—PLANT—Sarnia Bridge Co., R. Norton, genl. mgr., 251 Campbell St., 1 story, 70x160 ft., concrete block plant addn., to R. McKay, 291 N. Mitton St. Est. **$45,000.** Awarded 12/12.

Ont., Toronto — PLANT — James Morrison Bros. Mfg. Ltd., 276 King St. W., 3 story, bsmnt., brick mill plant exten., to Chestnut-McGregor, Ltd., 96 Bloor St. W. About **$45,000.** M. Brown, Confederation Life Bldg., archt.

★**Que., Almaville**—FACTORY — Shawinigan Chemicals Ltd., Shawinigan Falls, chemical products factory, to Fraser-Brace Eng. Co. Ltd., 107 Craig St. W., Montreal. **$1,500,000.**

Que., Hull—PLANT—Canada Packers Co. Ltd., Montreal St., plant exten., to F. E. Cummings, 128 Richmond Rd., Westboro (Ottawa), Ont. **$40,000.**

Que., Hull — PLANT — Hull Iron & Steel Foundries, Ltd., 207 Montcalm St., factory exten., to E. Brunet & Son, 35 Aylmer Rd. Est. **$40,000.** CD 12/9—ENR 12/11.

Que., Verdun — FORGE SHOP — Dominion Textile Ltd., 710 Victoria Sq., Montreal, forge shop, alterations, to Collet Bros. Ltd., 1978 Parthenais St., Montreal. **$50,000.**

Que., St. Joseph de la Baie du Febrve (P. O. La Baie)—MILL—Co-operative de Lin du Baie de Febrve, St. Joseph, flax mill, equip., day labor. **$40,000.**

PRACTICAL SHIP PRODUCTION

By A. W. Carmichael
Formerly Commander, Construction Corps, U. S. Navy

This book gives you the necessary explanation of the special elements of ship construction, also instructions in every step of shipbuilding—in simple, detailed form—just the thing for self-study by mechanics and technical men who want to get and hold ship construction jobs, and for company use in training new shipyard workers.

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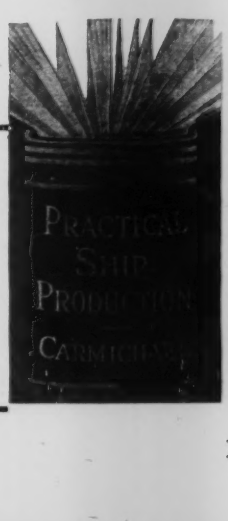

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SEND COPY TO OFFICIAL PROPOSAL DIVISION, ENGINEERING NEWS-RECORD, 330 W. 42ND ST., NEW YORK, N. Y.

Bids: January 6 (736)

Improvements to Electric Generating and Heating Plant Buildings

VILLAGE OF WATERLOO, WISCONSIN

The Waterloo Water & Light Commission of the Village of Waterloo, Wisconsin, will meet in the City Hall January 6, 1942, at 7 o'clock P.M., to receive and publicly open proposals for furnishing labor and materials to construct alterations and enlargement of the existing municipal electric generating and central heating plant building; rearrange existing auxiliary equipment and piping; construct foundations for and furnish and install a coal fired steam generating unit, with coal handling equipment, stoker, forced and induced draft equipment, chimney, and appurtenances and accessories; a bleeder type steam turbo-generator with surface condenser equipment, switchboard panel, appurtenances and accessories; a deep well with deep well pump to supply condensing water; motors, controls, and electric wiring; a centrifugal boiler feed pump and controls; and the necessary steam and water piping systems for connecting the new equipment and interconnecting to the existing plant; all for the municipal electric and heating utility of the Village of Waterloo, Wisconsin.

Plans and specifications will be on file in the office of the Secretary of the Waterloo Water & Light Commission in the Village of Waterloo, Wisconsin, where they may be examined by interested parties.

Plans and specifications for personal use may be obtained from the Engineers, the Commercial Testing & Engineering Company, 307 North Michigan Avenue, Chicago, Illinois, upon making a deposit of $10.00 for each set. Plans and specifications are to be returned complete within thirty (30) days after the date of receiving bids. The deposit will be refunded upon such action. The letting of the work is subject to the provisions of Section 66.29 Wisconsin Statutes, 1941.

This notice is given and published pursuant to the authorization and direction of the Village Board of the Village of Waterloo, Wisconsin, and upon the order of the Waterloo Water & Light Commission of the Village of Waterloo, Wisconsin.

Dated this Eighth day of December, 1941.

Albert Gorder, President
Chester Palmer, Secretary
Jerome Zibell
WATERLOO WATER & LIGHT COMMISSION

The complete official notice appears in the December 11th and 18th editions of the Waterloo "Courier."

Engineers: Commercial Testing & Engineering Company, 307 North Michigan Avenue, Chicago, Illinois.

Bids: January 6 (734)

Bridge

NOTICE TO CONTRACTORS:—STATE OF NEW YORK—TRANSIT COMMISSION (Metropolitan Division—Department of Public Service)—270 Madison Avenue, New York, N. Y. FOR THE CONSTRUCTION OF THE BRIDGE REQUIRED FOR THE PROPOSED ALTERATION OF THE MANNER IN WHICH THE BRONX RIVER PARKWAY CROSSES THE TRACKS OF THE NEW YORK AND HARLEM RAILROAD COMPANY (leased and operated by THE NEW YORK CENTRAL RAILROAD COMPANY, HARLEM-ELECTRIC DIVISION), AND RELATED STRUCTURES, IN THE BOROUGH OF THE BRONX, NEW YORK CITY, N. Y. Pursuant to the provisions of Chapter 481, Laws of 1910, Chapter 936, Laws of 1935, and amendments thereto, and under the rules and regulations for projects financed in whole or in part with Regular Federal Aid, Grade Crossing or Secondary Highway Funds, appropriated by Section 5 of the Act of September 5, 1940, (Pub. No. 780—76th Congress), sealed proposals for the reconstruction of the above project will be received by the Transit Commission at the office of the Commission, 10th Floor, 270 Madison Avenue, New York, New York, until two o'clock P. M., Tuesday, January 6th, 1942, at which time and place they will be publicly opened and read. Maps, plans, specifications and proposal forms may be obtained at the office of the Transit Commission, 270 Madison Avenue, New York, New York, upon payment of Ten Dollars ($10.00) for the plans and proposal forms. Standard specifications are Two Dollars ($2.00) per copy. No refund will be made on plans, proposal forms or specifications. Plans and proposal forms may also be seen at the office of the State Department of Public Works, State Office Building, Albany, New York.

Preference rating A-7.

The proposal must be submitted in a separate sealed envelope with the name of the project plainly indicated on the outside of the envelope. Each proposal must be accompanied by cash, draft of certified check, payable to the order of "State of New York, Division of the Treasury", for a sum not less than five (5) per centum and not more than six (6) per centum of the gross sum bid. Such deposit must not be enclosed in the envelope containing the proposal. The retention and disposal of such cash, draft or check shall conform with the procedure specified in subdivision 2 of Section 38 of the Highway Law. The amount of the certified check accompanying the proposal of the bidder to whom the contract is awarded will be returned when 10% of the work under the contract has been completed.

Federal Special Provisions require that the minimum wages to be paid on this project shall be as follows, unless shown otherwise in the itemized proposal:

Skilled labor, ninety-five cents per hour; Intermediate Grade Labor, eighty-seven and one-half cents per hour; Unskilled Labor, eighty-seven and one-half cents per hour.

In conformity with the provisions of Articles 8 and 8A of the State Labor Law, the minimum hourly rate of wages has been established and is annexed to and forms a part of the Special Specifications for the project and may be ascertained by reference thereto.

The right is reserved to reject any or all bids.

TRANSIT COMMISSION
STATE OF NEW YORK
WILLIAM G. FULLEN, chairman
REUBEN L. HASKELL, Commissioner
M. MALDWIN FERTIG, Commissioner
MACK NOMBURG, Secretary

Bids: December 18 (710)

State Highway Work

STATE DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, ALBANY, N. Y., until one o'clock P.M., on THURSDAY, DECEMBER 18, 1941, for the construction and reconstruction of the following highway projects and grade crossing elimination:

County	Deposit for plans	Bid deposit	Type	Miles	Pref. Rating
			RECONSTRUCTION		
Broome....	$10	$25,000	24' Concrete 8"...	3.75	A-4 Serial 438-E
Cayuga.... (Cons. & Recons.)	10	28,500	28' Concrete 8"—Slab Br. Three 21' spans.	4.48	A-4 Serial 438-E
Livingston.	20	44,000	24' Concrete 8" 7" 8"; Misc. Work 3 span Girder; total length 401' 40' I-Beam Br.; 28' Slab Br. Widen 21' Slab Br.....	7.83	A-7
Steuben...	5	4,500	30' I-Beam Br. 22' Concrete 8" 7" 8" Appr. Misc. Work.	0.19	A-3 Serial 454-E
			GRADE CROSSING ELIMINATION		
Montgomery	5	9,500	100' Girder Elim. Struct. 22' Concrete 8" Appr....	0.20	A-7

Maps, plans, specifications, and estimates may be obtained at the office of the Division of Highways, Albany, N. Y., and at the office of the District Engineers in whose districts the roads are located. The addresses of the District Engineers and the counties will be furnished upon request. Plans may be seen at the office of the State Department of Public Works, State Office Building, Worth and Center Streets, New York City.

The deposit for Plans and Proposal Forms for each contract containing 1 to 15 sheets is $5.00; 16 to 30 sheets, $10.00; over 30 sheets, $20.00. A refund will be made in full to bidders for return of one set, in good condition, within 30 days of award, or rejection of bids; refund for all other sets in good condition, similar period, will be 50% of deposit.

Special attention of bidders is called to "General Information for Bidders" in the proposal, specifications, and contract agreement, and to the special provisions applying to projects financed with federal funds.

Proposal for each contract must be submitted in a separate sealed envelope with the name and number of the contract plainly endorsed on the outside of the envelope. Each proposal must be accompanied by cash, draft or certified check payable to the order of "State of New York, Division of the Treasury," for the sum as specified in the advertisement and the proposal. The retention and disposal of the bidding check, the execution of the contract and bonds shall conform to the provisions of the Highway Law, as set forth in "Instructions to Bidders."

When optional types are permitted on contracts with federal funds, bidders must state in the space provided in the proposal the exact designation of the optional type upon which the proposal is predicated.

Minimum Wage Rate per hour for above work shall be as follows:

County	Skilled Labor	Intermediate Grade Labor	Unskilled Labor
Broome.....	$.75	$.62½	$.62½
Cayuga.....	.75	.55	.50
Livingston.....	.75	.55	.50
Montgomery.....	.75	.55	.55
Steuben.....	.75	.60	.60

Unless shown otherwise in the itemized proposal for each project.

The right is reserved to reject any or all bids.

A. W. BRANDT
Supt. of Public Works

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CONSTRUCTION BY CONTRACT
THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA, INC. - MUNSEY BLDG., WASH. D.C.